

The science news monthly

SCIENCE DIGEST

SEPTEMBER 1966

50 CENTS ICD

YOUR HIDDEN LIFE ASLEEP

7 amazing new findings
you should know—p. 63

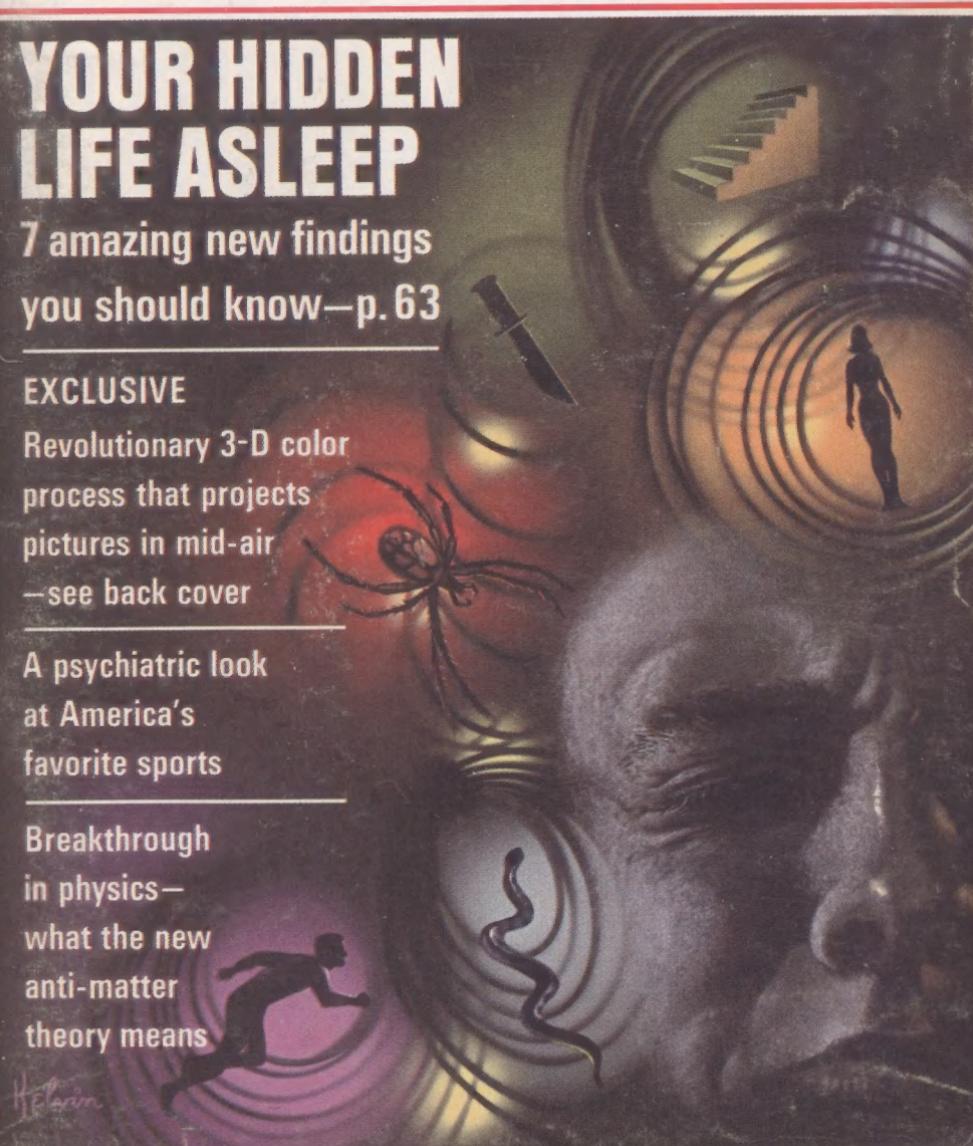
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The science news monthly

THE inquiring mind of science reaches today into all areas. Few articles we have published point this up so sharply as the one in this issue on sleep.

Most non-scientists and a great many scientists, too, can be forgiven for supposing that sleep, as Gertrude Stein said of a rose, is sleep is sleep. It's there, people use it all

THIS MONTH

the time, there's nothing but an occasional dream to remember about it, and that's that.

Now science is amassing an enormous body of knowledge of what actually goes on in this supposed state of unconsciousness. In fact, 24 laboratories in the United States are devoted to studying the subject.

You'd never think so much could be found out about what seems so insignificant—and that so much remains to be discovered. If you have any doubt of that, you won't after you've finished the report.

The fact is that our article, based on a U. S. monograph, only suggests the scope of the work. When we left something out to keep the article within bounds, we hated ourselves. But there's a solution:

Send for Public Health Service Publication No. 1389, enclosing 65 cents, to U.S. Government Printing Office, Washington, D.C. 20402. Or read *Sleep* (Coward-McCann, \$5.95), co-authored by Gay Gaer Luce, who wrote the P.H.S. book.

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Science Digest—September, 1966

DIGEST

We remember little of the eight or so hours we spend asleep each night. Yet much of this time, our brains and bodies are active. Now science has begun to explore this hidden third of life, uncovering remarkable facts. See page 62.
Painting by George V. Kelvin



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THE LATE SCIENCE NEWS

ASTOUNDING SURVEYOR. Scientists finally lost contact with Surveyor 1, but only after the three-legged robot had sent back more than 11,000 photos from the moon and survived the intense cold of a three-week lunar "night." Final loss of contact was caused by a dead battery.

MARS FLY-BY IN '69. NASA announced that two heavily instrumented Mariner vehicles will be launched toward Mars during the period from February to April, 1969, when the earth and Mars will be in favorable positions. The vehicles will be equipped to send back panoramic as well as detailed photos, in addition to other information.

DRY ICE ON MARS? Data from Mariner 4 indicates that the Martian ice caps may be composed of frozen carbon dioxide (dry ice) rather than frozen water. Drs. Robert B. Leighton and Bruce C. Murray, who proposed the theory, say, however, that there may be much frozen water underground on Mars.

A STAR IS BORN. An X-ray detector on a rocket may have located a star in the process of birth in this part of the Milky Way Galaxy. The infant star has been identified by its intense X-ray emissions. Distance of the object has been estimated at less than 30,000 light years--quite near on an astronomical scale. A detailed analysis of photos taken by the same rocket may show whether the object is yet visible as a star.



U.P.I. Photo

GEMINI SUCCESSES. Looking bearded and weary shortly after recovery, Gemini 10 astronauts John Young (left) and Michael Collins completed one of this nation's most complex and successful manned space flights. There were several important "firsts" during the mission. Gemini 10 provided the first real test of the vital docking procedures. In fact, two docking experiments were carried out. The first was with an Agena target launched the same day as Gemini 10; the second, with an Agena launched months before for Gemini 8. Young and Collins pushed farther into space than man has ever been--474 miles. And Collins became the first man to "walk" in space twice. In addition, he was the first man to go over and work on another orbiting object. Minor problems with the fuel supply, a contaminated air line and a lost camera did not keep the men from completing almost all tasks.

LESS FAT, MORE EXERCISE. A major report by noted medical specialists to the National Academy of Sciences National Research Council said Americans would benefit by exercising more and eating less food and less fat. However, the report did not recommend any major change in the average diet. The report was stimulated by mounting evidence that there may be some relationship between high fat diets and heart disease. A second report published by the Public Health Service also recommended less food and more exercise. The PHS document saw obesity as a major health, as well as an esthetic, problem.

PSYCHOLOGICAL HIGH BLOOD PRESSURE, ACNE. Placebos, inert sugar pills, have lowered high blood pressure and resulted in improvements in acne. In both cases, this indicates that psychological factors are at work. Persons who took placebos had their blood pressure lowered and kept down within a roughly acceptable range for as long as 24 weeks. Injections of salt solutions worked even better than the pills for persons with moderately high blood pressure. In some cases, the placebos worked as well as recognized drugs for high blood pressure. Acne also responded to placebos, but antibiotics were found to be more effective. The presence of powerful psychological elements in conditions like high blood pressure and other diseases emphasizes the need for extreme care in evaluating new drugs. Placebos are often used in research projects. If they are as effective as the drug being tested, the drug is not working.

MUMPS VACCINE. A live-virus mumps vaccine has proved at least 97 percent effective in protecting children against the disease. The vaccine, developed by Dr. Maurice R. Hilleman of the Merck Institute for Therapeutic Research, West Point, Penna., will have to undergo large-scale clinical trials, however, before it can be considered safe and effective enough for government license. Particularly important is the prospect that the vaccine will give long lasting immunity that will protect people into adulthood. Mumps is considered a minor ailment for most children, but for adults the illness can be dangerous.

ELECTRICAL PAIN KILLER. Severe, persistent pain has been blocked by inserting a needle into the upper spinal column and delivering a dose of electric current to the nerves that carry pain impulses to the brain. Preliminary tests show the method to be more effective than conventional treatments in relieving the pain of advanced cancer and other diseases.

VIETNAM MALARIA. Researchers have found a medication effective against a drug-resistant type of malaria common in Vietnam. Malaria has become a major problem for U.S. troops there. The drug, called DDS, reduced malaria 50 percent, and those still stricken had less severe cases. DDS has long been used against leprosy.

CLOT DISSOLVER. Reports indicated that early work on urokinase, which dissolves blood clots inside the heart, may lead to a major national research program.

SLOW ICE AGES. A study of recent data led two scientists to establish a new time table for the ice ages that repeatedly buried much of North America. Drs. William L. Donn and Maurice Ewing suggested that the ice ages did not develop abruptly, as many had believed, but gradually over millions of years of cooling.

CHUNNEL DELAYS. Both British and French governments agreed to construct a tunnel beneath the English Channel (called the chunnel), but work probably will not begin until at least 1969. The governments are looking for ways to raise the \$580 million that the project will cost.

ALASKA RADAR ANTENNA. Another giant radar antenna was put into operation. It is part of the U.S. Ballistic Missile Early Warning System. The ultrasensitive 84-foot parabolic dish antenna is located at Clear, Alaska. It can detect a 1/32nd-inch-diameter piece of wire at 2,500 miles. The new antenna is one of five operated by the Western allies. The four others are located at two sites in North England.

QUOTE OF THE MONTH: "From a practical point of view, a determination of whether or not any one individual is too fat is rather simple and does not require scientific acumen. An easy answer without weighing oneself on a scale is to look in the mirror. A realistic appraisal of the nude body is often a more reliable guide for estimating obesity than body weight."--Public Health Service report on Obesity and Health.

THE PHYSICS STORY

Death of a theory



Dr. Paolo Franzini of Columbia University and his wife Dr. Juliet Lee-Franzini of Stony Brook directed the experiment that disproved a long-standing physics principle.

by Margaret L. Silbar

A PROMINENT experimental physicist once remarked: "The most important fact about the universe is that there are things which do not change."

Physics is, in large measure, dedicated to the search for these immutables, the invariance principles. As experimental data has accumulated, more and more invariances and their resulting symmetries have been revealed.

Recently, however, we took a crucial step backwards, but we should learn a great deal from it, for puzzles and progress seem to go together in science.

Experimental physicists, working

at Columbia University and the State University of New York at Stony Brook, have uncovered a remarkable idiosyncrasy in the decay of the eta meson, one of the "fundamental" particles of matter. Their finding:

$$\eta^0 \rightarrow \pi^+ + \pi^- + \pi^0$$

While this "equation" may look a bit Greek to you, the letters are nothing more than names of particles. The superscripts, $+-+$, give their electric charges. The arrow means "decays into." The finding shows the first violation, outside the weak interactions, of something technically called "charge conjugation invariance," or "C."

The intuitive layman (as well as the educated physicist) would feel in his stomach that there would be a symmetry between the two charged pions, the π^+ and the π^- produced in the decay. What could happen to one, in other words, could just as well happen to the other. Or interchanging the signs of the charges (converting each pion into its antiparticle) would leave things looking the same.

It turns out that this symmetry, C, is broken. When the eta decays, it gives the positive pion more energy, on the average, than the negative pion. This asymmetry is small, being only about five percent.

C-violation had been hinted at

previously, but this is the definitive experiment. Odds of 80,000 to 1 are quoted against the possibility that, in the combined experiments, the observed C-violation is only a statistical fluctuation.

Since this new violation is apparently in the electromagnetic interaction ("the oldest, most-firmly established force known to man"), it is necessary to know something about what the forces are. We presently recognize four: strong interactions, which bind nuclei; electromagnetism, which binds atoms and molecules; weak interactions, which account for radioactivity; and gravity, which keeps us from falling off the earth. These are listed in order of decreasing strength; it is curious and ill-understood that the weaker the force, the less symmetrical it is.

Ten years ago, C-violation was found in the weak interactions. Now we see it in electromagnetic interactions. One difference between the two discoveries is that weak forces have little to do with our macroscopic world. This cannot be said about electromagnetism, which is responsible for all chemistry.

In addition to forces, there are conservation laws, as indicated in the first paragraph. Every schoolboy knows energy is conserved. What he may not know is that this conservation law is subtly linked to an invariance principle—that natural laws do not change from day to day.

Conservation laws, then, are based on invariance principles.

Charge conjugation is related to a law called the CPT Theorem, the "P" standing for parity, the "T" for time reversal. P and T are operations much like C. CP is a combined operation; first C is performed, then P. CPT is "even more combined." CPT is not, however, conserved in quite the same sense as energy. A system can have any amount of energy, but its "amount" of CPT is either +1 or -1. The assumptions of the theorem are so general and basic that one physicist has said, "Man is so unimaginative that he is completely unable to think up a theory which violates CPT."

What do these operations, CPT, imply? C, we have already discussed. Parity is often explained by talking about mirrors: A right hand viewed in a mirror appears as a left. Physicists once thought that Nature showed no preference for right or left hands. (The fact that man prefers his right hand is a biological accident.)

Time reversal is related to charge conjugation—an antiparticle can be considered as a particle moving backwards in time. The canonical analogy for explaining time reversal invariance is that a movie of bouncing billiard balls run backwards looks the same as "true life." But T would hold only on the microscopic level. A broken egg flowing back together is macroscopically improbable.

We once believed that each of these operations, C, P, and T, was separately conserved, that the world

Now there is an absolute way of telling matter from antimatter

looked the same before and after the performing of each. Then, almost simultaneously, violations of parity and charge conjugation were seen in the weak interactions. Both were broken "maximally," as much as possible, but in such a way that the combined operation, CP, was still thought good. We now know that the only operation of this kind which is conserved for all interactions is CPT.

It all began with the Tau-Theta Puzzle. In 1956, there seemed to be two particles of different parity, called the tau and the theta, which were identical in all other respects. T. D. Lee and C. N. Yang's Nobel prize-winning idea was that the two were the same particle (now called the kaon) and that parity broke down in the weak interactions.

This loss of symmetry in weak interaction theory could have been ugly. But physicists soon realized that a more economical and beautiful theory existed: Maximal parity violation was compensated for by maximal charge conjugation violation and the symmetry, CP, held.

This "answer" remained a happy one until the summer of 1964, when it was found that the long-lived neutral kaon decayed into two pions, contrary to a prediction of CP-invariance. (The kaon, incidentally, showed us both P- and CP-violation.) Weak interactions

were again in danger of becoming ugly.

This CP-violation, however, could not be clearly attributed to the weak interactions. Lee was somewhat unwilling to deface the handsome edifice of this theory (for which he was more than partly responsible). He pointed out that charge conjugation invariance had never been established for the electromagnetic interactions. Hence, the Columbia-Stony Brook experiments and this discovery.

It now seems that the weak interactions still conserve CP, and thus T (by the CPT Theorem). On the other hand, the electromagnetic interactions violate C, and presumably T, since parity is known to be conserved for electromagnetism. The hope, therefore, is that the electromagnetic interactions have maximal C- and T-violations, but such that CT is preserved (reminiscent of the weak theory). The decay of the long-lived kaon, which breaks CP, would then be understood as an electromagnetic correction to a basic weak process.

The next task of experimentalists is to look for a direct confirmation of time reversal violation in electromagnetism, as well as to verify C-violation in other situations. There are also plenty of gaps for theoreticians to fill in.

Regardless of where else violations might appear, the current discovery may have some practical implications. For now there is an absolute way of telling right from left, antimatter from matter.



Why people play football . . .

by Flora Rheta Schreiber
and Melvin Herman

SPORTS usually go their way without undue brooding about them. Recently, however, they have come under psychiatric scrutiny in an effort to understand the psychological and social purposes they serve.

Dr. Chester M. Pierce, research psychiatrist of the University of Oklahoma Medical Center, has studied the reasons why husky men will practice Saturday or Sunday afternoon mayhem all season long this fall.

"Men play football to master adversity," says Dr. Pierce.

Once a man has had the privilege of testing himself against adversity, the doctor maintains, he will be able to operate more confidently in

all areas of life. Happiness, too, may be nearer this man's reach, for Demetrius said 2,000 years ago, "No one is more unhappy in my judgment than a man who has never met adversity."

The football player actually is a mirror reflection of modern man. The dilemma for all of us is the same, Dr. Pierce says—"how one handles aggression, yet abides by rules which dictate in what way one can eliminate his opponent, be he friend or enemy." The doctor adds:

"The worst position for both modern man and the football hero is to be in a situation where he cannot demonstrate a proud courage which displays assertive adequacy in meeting a challenge."

Those of us who do not play, but watch, find in football a vicarious

outlet for our own conflicts, aggressions and self-image of prestige. At the same time that we enjoy ourselves, we find reassurance in the demonstration of courage by members of our society. The importance of teamwork illustrates the necessity of working together efficiently. The game becomes an antidote to loneliness, for the interdependency of man on man is expressed. The quarterback, no matter how skilled, has to have a receiver for his passes and the plunging back can only get his name into the headlines with the help of a hole-making guard.

While we watch and relish, the players themselves do even more. To them comes the grandiose benediction of omnipotence. Theirs is an unalloyed engagement in magical thinking that somehow they will score an upset, even if they labor under the awesome knowledge that their very best is too puny even to unruffle their opponents. Even if defeat was their lot last Saturday, they are certain that today, irrespective of the odds, they will win. Somehow, some way, they're confident they'll find some way to snare their bigger, huskier All-American opponents.

The contest itself, however, spurs confidence—a phenomenon outside the ken of the non-competitor. Along with confidence, too, is the reveling in one's own strength and skill.

Miss Schreiber is an award-winning writer on psychiatry: Herman, the Executive Secretary of the National Association of private Psychiatric Hospitals.

"If one is an excellent competitor," Dr. Pierce remarks, "he is courted in a manner sometimes far beyond what is seemly for mere mortals." Then, in the jargon of the psychiatric trade, he adds, "The football player resolves conflicts concerning sexual identity and the balancing of dependency against inter-dependency."

At the same time that the game is outwardly tough, it is tough, too, inwardly. A football player, like any other competitive athlete, must develop defense mechanisms and must cope with feelings of guilt. Somehow, when he fails, he feels that blame has been placed on him. Again, for each omission and commission, he is subjected to intense shame and guilt pressures.

If the football player is the mirror reflection of modern man, the game itself, as David Riesman, the author of *The Lonely Crowd*, has described it, is a gauge for understanding modern society. Riesman stresses physical contact and daring as representative of important motifs in our way of life.

Other sports, such as auto racing, more than football, involve absolute consequences. Yet each weekend on the football field, physical contact and daring are displayed and enjoyed, even though a vast amount of physical damage takes place. The high school football player, for instance, is 13,666 times more likely to receive a disabling injury than a coal miner. This means the player must expect not only to inflict injury but also to absorb it. Virtually

all players, whether on the offensive or defensive squads, are likely to emerge from their football careers with mementoes of their injuries.

Again, our society—in its highly competitive phase—is represented in the football regulations, which undergo constant revision, just as does the law. Football ritual and traditions, too, are protected with almost religious fervor and fidelity. The football coach is expected to be a practical philosopher who teaches his charges exactly what are their rights, obligations, duties and privileges. Pared down to the core, this means that he teaches them what they can and cannot get away with—which is an implicit injunction of our get-ahead social philosophy.

Some of the parallels between football and society are sinister. Football is a game of vengeance. Nothing can go unanswered, just as in baseball, where one bean ball demands another. And, though football is a clean war, it can also be a dirty one. For, within a framework of rules, the coach, the tribal head, teaches his sons, "that murder is sanctioned, hoped for and encouraged."

As a father surrogate with absolute authority, he gives his sons permission to injure others. Encouraging his sons in their fantasies of omnipotence, he also supervises them in their initiation into adversity. He is, in short, a wizard par excellence, an altogether magical figure, enjoying an image among his flock that many a real father can only envy.

There is also a parallel to relationships among brothers in the family. While, however, natural brothers stifle their rivalries or at least mask them, "brothers" in the football field express them fully. Each player must withstand the unending onslaught of the others working to displace him. To win his own place on the team, each must unseat the others.

At the same time, week after week in this all-male world, the football player, rough and tough, recognizes his brothers as belonging to a superior breed of men, whose worth repeatedly is proven. Together they share a dedication to incredibly rigorous training and discipline to meet grueling schedules, a mutual esteem of the body triumphant and the unmistakable sense of mastery that comes with knowing that one and all can go through the hell of it all without breaking.

... and baseball

Big-league baseball is seen by psychoanalyst Thomas A. Petty, M.D., of Grosse Point Park, Mich., as a tribal feast around the totem pole.

The roles of all the players are fixed by convention. The rules are inflexible and the game is laden with ceremonious ritual. The pitcher, who is placed even higher than the others on the mound, is the symbolic father, and the catcher, tough as he is, is the symbolic mother.

During the tribal feast, the fans play a significant role; they eat and drink tremendous quantities of such things as hot dogs and beer. The tribal feast ends, says Dr. Petty, in time to go home to dinner or a midnight snack.

Everyone is there for one purpose, to overthrow and destroy the primal father, not really as you thought, the umpire.

Dr. Petty, is a paper read before an American Psychoanalytic Association meeting, said that baseball is mock combat on a team scale and a personal duel between the pitcher and the batter. Statistically, each batter vies with other batters. But one group of batters is predestined to win the game. Although the main interest is in the pitcher, who more than any other player determines the course of the game. He hopes to dominate the batter.

Everyone has a chance to relive his earliest successes, according to Dr. Petty. The diamond is symbolic of the four-cornered area in which the infant took his first tentative steps, the crib, the play pen or his room.

... and golf

Another current theorist on the psychological purposes various sports serve, Dr. Arnold J. Mandell of the Department of Psychiatry, U.C.L.A. Center for the Health Sciences, sees an analogy between golf and—yes—psychotherapy.

"Both," he says, "are filled with tension. In golf, as distinct from

Russians Learn While Asleep

(WE KNEW IT ALL THE TIME)

News items appearing in newspapers and magazines throughout the nation report that: "In the Kiev State University, a woman student mastered a complete course in English in 28 nights."

"A philologist at the Ukrainian Academy of Science says that sleep-learning is less tiring to the brain than normal learning."

This "new" Russian discovery has been in use for over 2,000 years. In the United States sleep learning has been actively used since 1922 when Chief Radioman J. N. Phinney of the U.S. Navy successfully taught Continental Code during sleep. Since then, the use of sleep as a time for learning every kind of material, has become a reliable and accepted addition to our learning programs. The technique of sleep learning is being used by professionals, students and instructors, sales and corporate executives, housewives and mothers . . . along with many personalities in the public eye such as: Jan Sterling, José Ferrer, Red Buttons, Efrem Zimbalist, Jr., Sam Wanamaker . . . and many others — who use the time of sleep to absorb information effortlessly and painlessly for instant recall when awake.

To acquaint the readers of this newspaper with the simple techniques that allow constructive use of your sleeping hours, the Self-Development Research Foundation, a leading researcher in the field of learning while asleep, has published a compilation of Research Studies. These easy to understand reports tell you how to absorb any material while you sleep. Learn languages; learn to relax and control tensions; control your weight; sharpen your memory; develop your sales ability — all while you sleep, and without losing your rest.

This 26 page report is yours free. No obligation and no one will call. Simply enclose a dime to cover cost of postage and handling. Send your name and address to: Self-Development Research Foundation, Dept. Y-23, 207 East 37th Street, New York, New York 10016. Please include your ZIP CODE.

most other sports, no direct aggressive discharge against an opponent is allowed. In psychiatry, unlike most medical specialities, the psychiatrist is not allowed to act out his tensions on the body of his patients. The adequacy of performance in golf and psychotherapy is a complex function of the participants' emotional state. Complete understanding of success or failure, in both escapes the participants.

"Both psychiatry and golf are also performed in personal isolation with a great deal of internal dialogue. And in both there are desperate efforts to master the almost metaphysical relationship between cause and effect."

... and tennis

If team sports are oriented to the group and the culture and golf is essentially intrapsychic, tennis is interpersonal. Tennis, however, is not a mere casual Sunday-afternoon killer. As Dr. Roy M. Whitman, associate professor of psychiatry, Department of Psychiatry, University of Cincinnati College of Medicine, puts it, "There are murderous impulses in tennis, even though they are unconscious."

Tennis is obviously a competitive struggle for success and this has crucial consequences for the psychology of the sport. There is a sharp contrast between the courtly (pun intended) etiquette, which includes spotless whites so as not to distract the opponent's eyes from

the ball, singing out "good shot" when an opponent belts one, shaking hands at the end of the game and the fact that the most powerful shot in the game is the "kill!"

Nor should we forget that tournament players are notorious for their murderous tempers, yet, through tradition, have the perfect scapegoat in the referees or ball boys. They preserve their etiquette at the same time that they give vent to their rages. That sheer pleasure is not the major ingredient becomes obvious from the fact that, in a tournament, pleasure evaporates quickly and even in an everyday game, the losing player would like to stop but cannot.

"In tennis," Dr. Whitman suggests, "you might be killing off your father—not by making him play too many sets under the hot sun, but by coming up to the point where you overtake the older player, the experienced teacher-player. The occasion is the more significant by virtue of the fact that most of the ranking players were taught to play tennis by their fathers or a father figure."

Guilt—that hardy perennial of all competitiveness—is present, too, in tennis. When, for instance, a tennis player berates himself—as tennis players constantly do—for not performing well, the berating serves to balance guilt for being successful and at the same time provides punishment for failing.

Another element in the game of tennis is the instinct of territorial rights.



THE SPACE PICTURE

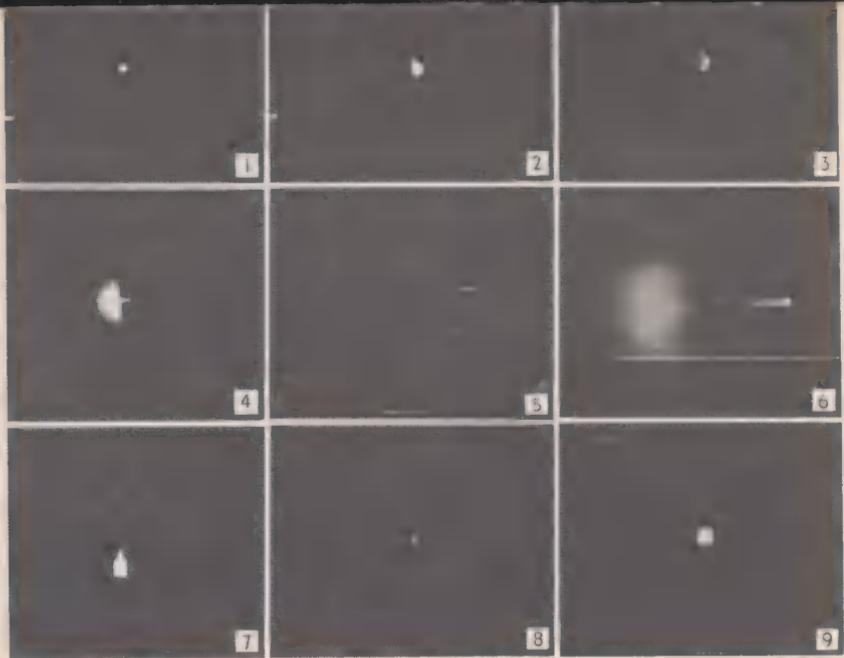
29-ton satellite

A SATURN 1B rocket successfully orbited the nation's heaviest (29-ton) satellite (left). But the launch was no mere weight-lifting gesture. The satellite was filled with volatile liquid hydrogen, the fuel that will power Apollo astronauts on the final leg of their journey to the moon. The launch was a test of new techniques to preserve the fuel until needed. Aim was to keep the tricky liquid super-cold and prevent it from sloshing around dangerously and exploding.



The Anchored IMP

Artist's conception shows the path of the Anchored Interplanetary Monitoring Platform, designed to swing in a wide lunar orbit to study the moon's environment.



Photography at 2,600 miles

The final stages of the PAGEOS-A Geodetic balloon satellite as it achieved orbit some 2,600 miles above the coast of South Africa were successfully photographed by the Smithsonian Astrophysical Observatory's South African station. Frame 1 shows ignition of Agena rocket booster/payload combination. Frames 2 through 6 show build-up prior to separation. Frame 7 shows satellite in orbit but before inflation process began. Inflation of the "satelloon" to its full 100 feet diameter is shown in 8 and 9.

Gemini veteran

Astronaut John Young, who was aboard the first manned Gemini mission, was command pilot for 3-day Gemini 10 flight.

AMONG some of the more remarkable space age devices are the giant Baker-Nunn satellite-tracking cameras (right). The cameras were originally designed by Dr. James Baker for aerial photography and modified by Smithsonian Astrophysical Observatory engineers for space photography in the SAO's worldwide network of tracking stations. The cameras show the actions of satellites in orbit (above). And a new type of camera, shown here, photographs satellites against star backgrounds to pinpoint their exact position. Photos are used to make accurate geodetic measurements of the earth.





How Surveyor did it

Earth-based "drop" tests show how the phenomenally successful Surveyor was soft-landed on the moon. Test vehicle was dropped from tethered balloon at 1,000 feet.

One-ton camera

A new type of satellite-tracking camera (similar to the one that made the photos at the top of the facing page) is now in operation at a Smithsonian Astrophysical Observatory station in Greece. The camera will allow precise tracking of satellites.



THE PROGRESS OF MEDICINE

Doctors who disagree

By Arthur J. Snider

WHEREVER doctors assemble, in hospital locker rooms, at medical meetings, social gatherings, at conventions, they are likely to get into an argument over the relative merits of treatments.

Here are some typical disagreements between physicians:

- On ulcers:

The ulcer patient should watch his diet.—Dr. James L.A. Roth, University of Pennsylvania Graduate School of Medicine.

Let the ulcer patient enjoy his food.—Dr. Franz J. Ingelfinger of Boston University School of Medicine.

- On hardening of the arteries:

Both hardening of the arteries and blood clots are related to the daily diet.—Dr. Jeremiah Stamler, Northwestern University Medical School.

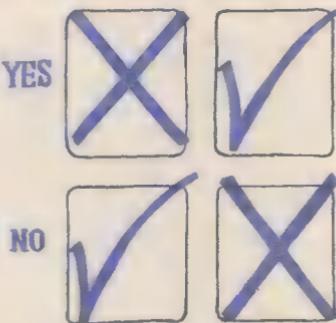
There is no demonstrable relationship between hardening of the arteries and fat nutrients.—Dr. Mark D. Altschule, McLean Hospital, Waverly, Mass.

- On high blood pressure drugs:

We need more convincing proof of the clinical usefulness of drugs in the treatment of high blood pres-

sure.—Dr. William Goldring, New York University School of Medicine.

The death rate from high blood pressure has declined significantly since the introduction of drug treatment.—Dr. William Hollander, Boston University School of Medicine.



Internal controversy, a side of the profession the public doesn't see, serves a valuable end. It gives the physician a chance to try out a new idea. It compels him to defend his position. He may discover holes in his logic, faulty interpretation of his data, a dearth of evidence, even an unconscious prejudice.

Now for the first time in a medi-

cal text, a publisher (W. B. Saunders Co., Philadelphia) has arranged a confrontation in print of opposing points of view about some two dozen diseases.

"Controversy in Internal Medicine" is edited by three Boston physicians, Franz J. Ingelfinger, Arnold S. Relman and Maxwell Finland.

One of the most frequent arguments offered by those opposing many of the current treatments is that they are resorted to as an alternative to doing nothing, even though it is admitted the treatment has little value.

Diet therapy of peptic ulcers is cited as an example. The editors contend that 95 percent of ulcer patients are given hard and fast dietary regulations, yet six prominent gastro-enterologists were approached before one could be found who was willing to put in writing a defense for a strict diet.

In opposing strict dietary management, Dr. Ingelfinger says that in addition to eliminating the joys of eating tasty foods, the treatment works only with a few patients of "proper psychiatric makeup."

"They may reveal in such rigorous and righteous self-denial," Ingelfinger points out, "but in most people one of two results is inevitable: Either they cheat on their diet or they eat their sparse food with grim determination, a situation not conducive toward mental relaxation, which everybody says the ulcer patient needs."

The Boston physician uses this

rule of thumb: "To the extent that foods stimulate gastric acidity but have no compensatory advantageous effect (such as coffee), they deserve to be eliminated. To the extent they are diluters and mild neutralizers of acid (such as milk), they may be used as part of a regular acid-neutralizing routine, provided their temporary effect is appreciated."

How to hex, unhex

Hypnosis has proved to be one of the best techniques for freeing Southern whites and Negroes from the belief that they are hexed, Dr. John E. Snell of Tufts University, Boston, finds. The hexing culture is still common in many rural communities in the South. With the movement of population from Southern farm areas to the cities, people who have been brought up surrounded by hexing beliefs may be seen more frequently in urban centers.

The hexing culture, says Dr. Snell, denotes a set of beliefs having their roots in American witchcraft, African folklore and West Indian voodoo. It ascribes the cause of disease or disability to the magical influence of a "hex" or "spell" placed upon the patient by another person.

Virtually any symptoms, physical or emotional, may be ascribed to the operation of a hex. Often a patient will explain his illness by naming his tormentor, although sometimes the source of the hex

remains unknown.

A common method of hexing one's enemy is to sprinkle sand or salt or pepper across his front step. When he steps over the material, the hex takes effect. To bury a knife, its point toward your victim's house, together with a bit of his hair, nails or sweepings from his floor, especially if it is done at sunrise on a Friday or in the dark of the moon, is thought to be a highly effective hexing technique.



Before being seen by a physician, a sick person who feels he is hexed usually consults a lay practitioner who abounds in rural areas and even in the cities. These healers are called "root doctors." One treatment is to burn a candle for each symptom while the root doctor preaches and prays that the evil spell placed by the hexer will be removed.

Hypnosis is useful because the hexing culture renders the patient more susceptible to trance, Dr. Snell points out. Under hypnosis,

the patient is given suggestions that tend to diminish his concern about the fear of being hexed.

Memory pills work

First clinical reports on the new "memory pill" are cautiously favorable. Tried on 24 elderly patients in Albany, N.Y., the drug brought about improvement ranging from "slight to considerable," according to Dr. Ewen D. Cameron, director of the Veterans Administration Hospital research laboratory on aging. It worked better on those with a higher "memory quotient" than on those whose memory had badly deteriorated.

The pill is produced under the trade name of Cylert by Abbott Laboratories, North Chicago. Officials commented that it "is still a long road from first clinical results to the ultimate evaluation in humans of an experimental drug of this type."

Among patients who benefitted, Dr. Cameron says, was a club woman who had dropped out of activity because of long lapses of memory. She is again socially active. A bridge player who could not remember cards is resuming the game.

In introducing the drug in December, 1965, Abbott reported experimental rats learned four or five times faster than animals not given the substance. Theoretically, Cylert steps up the activity of an enzyme having to do with the manufacture of nucleic acid, the basic

material of genetics. In recent years, nucleic acid has been suggested as a memory encoder.

Life-saving sports

A study of the records of 45,000 former students at Harvard and the University of Pennsylvania is shedding light on factors that may precede the development of high blood pressure and coronary disease. Data gathered from student's physical, environmental and psychological records have been correlated with their later health status, as measured by answers to questionnaires, alumni records, death certificates, etc.

Of the first 590 male coronary deaths, nine characteristics have been identified as distinguishing each victim from two living classmates chosen at random.

The strongest influence was heavy smoking of cigarettes. Although collegiate smoking patterns may have changed later in life, smoking half a pack daily in young adulthood was associated with 60 percent higher coronary mortality.

Participating in college athletics appeared to be protection against coronary death. There was an inverse relationship between engaging in varsity sports and later coronary death.

Students with emotional problems, such as anxiety or depression while in college, has twice the rate of coronary attacks before age 45, but only a slightly higher risk thereafter.

Short body stature (less than 68 inches), loss of father or mother before entering college, and being an only child were other characteristics that showed some contribution to coronary disease.

Another factor was scarlet fever in early life.

Dr. Ralph B. Paffenbarger, head of a U.S. Public Health Service team conducting the study said there may be other characteristics uncovered that will indicate the coronary-prone individual. These should enable physicians to recommend measures to reduce the individual's heart-disease risk at a time when such measures are likely to be effective, he said.

"Prevention, rather than cure, is the goal sought here," he said. "Untimely death from heart disease for so many men at a time when their productive capacity is at its highest constitutes a tremendous community loss."

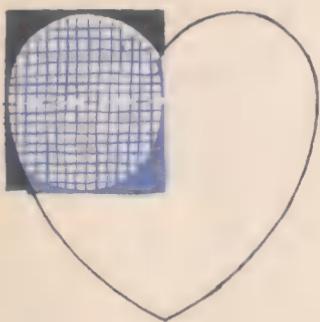
10-year pacemaker

The world's first nuclear-powered heart pacemaker is under development. It will permit the device to be implanted in the body to maintain the rhythmic beat of the patient's heart for at least 10 years. At present, the pacemakers are powered by chemical batteries which must be replaced at frequent intervals by surgery.

About 10,000 persons in the United States require pacemakers to overcome heart block, a condi-

tion in which the stimulus to the heart muscle is interrupted. Pacemakers have been implanted in persons ranging in age from six months to 94 years.

Prior to the development of the pacemaker, cardiac patients with heart block lived precariously. With a pacer surgically implanted in the fatty portion of the abdomen or in the muscular portion of the chest, most users can live near normal lives.



The first reported work on heart pacers was done by Dr. P. M. Zoll of Beth Israel Hospital, Boston, in 1952. These were designed for external stimulation of the heart.

The concept of internal stimulation was originated by Dr. C. Walton Lillehei of the University of Minnesota in 1957. The first successful implantation was reported by Dr. William M. Chardack of the Veterans Administration Hospital, Buffalo, N.Y., in 1960.

Up to this time, all pacers operated at a fixed rate. In 1963, Dr. David A. Nathan and Dr. Sol Cen-

ter of Mt. Sinai Hospital, Miami Beach, reported use of a pacer which was synchronous to the patient's arterial rhythm.

The pacemaker, being developed by the Nuclear Materials and Equipment Corp of Apollo, Penn., for the Atomic Energy Commission, will be about two-thirds the size of a package of cigarettes. The nuclear unit itself will measure only one inch by three inches by three inches and weigh 3.4 ounces. The concept is expected to have medical applications in the treatment of diseased organs other than the heart.

Cure for a tic

Painful tic douloureux is yielding to treatment with a drug called carbamazepine. The usual treatment, surgery, can leave a severe cosmetic defect, particularly a drooping of the face.

Dr. William Amols, a neurologist at Columbia University College of Physicians and Surgeons, New York, says 80 of 100 patients given carbamazepine during the last two years had been helped. In most cases, there was complete elimination of pain. The patients, ages 29 to 89, also reported they were once again able to brush their teeth and eat solid food, practices that had been too painful in the past.

Tic douloureux, also known as trigeminal neuralgia, is an inflammation of the fifth cranial nerve, responsible for carrying sensory impulses to the brain from the face.

INVENTOR OF THE MONTH

His computer figures geography



A COMPUTER patented by Warren Jackson, Jr., tells his employer, the Standard Oil Company (Ohio), where to put its warehouses. So far, it has selected Fostoria and Twinsburg, Ohio, as locations for the storage of Sohio packaged goods—the thousands of articles and liquids that come wrapped, boxed, canned or in drums.

The computer has to consider the source and the destination. In the case of a tire, it computes the distance from the producing factory and the distance to which delivery must be made at one of the company's service stations.

The machine takes into account all the items to be housed and decides what site is best from the standpoint of over-all economy in transportation.

Jackson, the *Science Digest* Inventor of the Month, recently obtained Patent 3,256,427 (his fourteenth) for the "facility location computer." He is senior project leader on the management science staff at Cleveland.

In programming the Jackson analog computer, the operator feeds in geographical locations, by latitude and longitude, and the tons of various supplies to be moved. By twisting a pair of dials, he turns the computer's attention from one point on the map to another to find out what each location would require in total ton-mileage. The figures show on a meter dial.

Although the computer's assignments to date have involved only packaged goods, the patent suggests future jobs for it in planning the distribution of bulk products such as gasoline and heating oils, in placing refinery equipment where the piping costs will be least, and in telling the telephone company where a central office will entail the minimum expense for cables.

The inventor, who has been with Standard Oil of Ohio for 19 years, is a graduate of Purdue University and has a master of science degree from Case Institute of Technology. He is active in Simulation Councils, Inc., a scientific group.

—Stacy V. Jones

INVENTIONS PATENTS PROCESSES

How to predict an earthquake



Laser beam goes 10 miles from (1) to (2) and is retransmitted. Changes in optical path show shifts in subterranean rock structure preceding earthquake.

DUAL laser beams—one red (visible) and the other infrared (invisible)—are the spearhead of a new earthquake-prediction technique employed by scientists at North American Aviation's Space and Information Systems Division.

The lasers are used to measure earth faults, fractures in the earth's crust caused by shifts in subterranean rock strata. These shifting movements are continuous but so

tiny that they're discernible only to the most sensitive instruments.

By measuring these movements, scientists can pinpoint a major area of stress and hopefully predict an oncoming earthquake.

To test the accuracy of the twin-laser technique, North American scientists set up a mobile lab on Strawberry Peak, one of the highest points in the San Bernardino mountains in California. On another peak ten miles away, they constructed a corner reflector array to receive and then bounce back the signals from the mobile lab's laser beams.

Not only did they measure changes in the optical path as small as $\frac{1}{5}$ of an inch, but the technique proved it could function during either day or night and also make adjustments for atmospheric variations.

It will be possible for a more sophisticated version of the dual-laser technique to gauge optical variations as small as $\frac{1}{25}$ th of an inch for a distance of ten miles.

This technique, which the government calls Project GLASS (Geodetic Laser Survey System), is being considered as a monitoring system for the San Andreas fault zone, which stretches from the Gulf

of California to a point south of San Francisco.

The Presidential Committee for Earthquake Detection has strongly recommended that some 20 twin-laser monitoring stations be strung along this highly vulnerable terrain. Data collected from the measurements of the earth's movements would be processed by a computer, according to North American Space Division scientists, allowing them to predict far in advance the onslaught of an earthquake.

Forecast formula

Blame for bad weather may soon be heaped upon an unheeding combination of six equations.

Developed by Dr. Frederick G. Shuman, director of the National Meteorological Center (NMC), the formula consists of equations representing basic physical laws of motion, continuity, thermodynamic energy and state.

Using this formula, a new weather prediction model has been built which can forecast the weather in 70 minutes up to 36 hours in advance.

This model, more sophisticated than previous versions, was operative six years ago. But it couldn't be put to use until scientists found a computer (the CDC-6600) powerful enough to cope with its complex mechanics and still meet forecast deadlines.

Continuously supplied with the most recent data observed around the world, the forecast model can

compute weather patterns for seven levels of atmosphere, from sea level to 53,000 feet.

Fingerprinted bacteria

A new technique using a laboratory chromatograph has shown that metabolic emissions of bacteria have distinctive patterns, "fingerprints" of the microorganism that may be used to distinguish one species from another.

The metabolic yield of a pure bacteria culture (mixed samples will be used next) is processed and injected into the chromatograph. The product travels down the instrument's column for its required length of time. At the end of the column, detectors pick up the signals generated by the molecules of the sample. The resulting pattern is then etched on the graph.

Each sample is assigned a letter and is listed in order of decreasing quantity. The different patterns among the bacteria are determined by the variations in quantity of the same metabolic products and the presence or absence of different products.

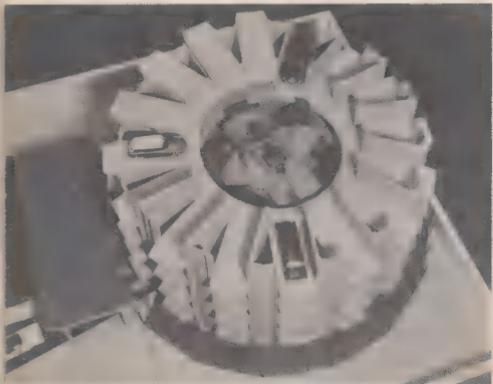
Not only have scientists been able to distinguish one species of bacteria from another, but strains within species have been separated.

The "fingerprinting" of bacteria has been under investigation for two years at the General Electric Electronics Laboratory in New York.

"The detection devices used at the output of the chromatograph

Inventors' show

Pictured are four of thousands of products to be on display at the 2nd Annual International Inventors and New Products Exhibition, September 9-18 in the N.Y. Coliseum.



Cars can be parked by punch cards on the totally automated vertical-horizontal delivery system (above). C. Hagel, Germany.



Six-year old Andrew Sobel of Brooklyn, N.Y., invented a tubular fishing rod that, when collapsed, can fit in a pocket.



Push-button attachment that goes for only \$140 permits driver to park any kind of car sideways. Sidler Ltd., London, England.

Power golf game simulates in miniature every conceivable situation on a 6,000-yard course. Thomas Bergstrom, New York.



are sensitive to less than one part per billion of certain organic molecules," says GE scientist John R. Gould. "Detection and identification that now takes days or weeks by classical methods could be done in hours."

The technique may eventually be applied to automated medical diagnostic equipment, hospital monitoring equipment and water and air pollution monitoring equipment, according to Laboratory officials.

Observatory on wheels

Scientists tracking satellites can now take their observatories and travel to a more advantageous location.

Built by Goodyear Aerospace Corporation, a new 16-ton mobile observatory can economically track the orbital flight of a satellite from any point accessible to a car. As the telescope follows the space-craft's path, it can measure changes in the craft's surface characteristics as they may be affected by heat, radiation, ultra-violet rays and meteorites in the space atmosphere.

The observatory unit is mobilized by a 10-wheel, van-type truck. On top of the truck is an eight-foot-square instrument enclosure and a platform that elevates for stable operation and folds out hydraulically to provide the 16-by-24-foot working area.

Astride a two-ton pedestal on the platform, the observatory's 24-inch telescope has a four-axis mount, unlike conventional two- or three-axis

mountings, which permits more facile and accurate tracking. The observatory also has an auxiliary power supply system, environment control and an instrumentation subsystem.

Smallest radar

A radar device weighing a scanty two pounds has been devised by RCA'S Missile and Surface Radar Division.

Claimed to be the smallest radar in the world, the model can be attached to a man-held firearm. It was recently developed to permit "blind" firing of grenade launchers, bazookas, and machine guns in jungle environments.

The radar functions on the basis of the doppler effect—the shortening of sound waves when an object is moving toward the listener (increase in pitch) and the lengthening of sound waves as it moves away (decrease in pitch). The radar's nine-billion-cycle signal is converted to sound frequencies. Changes in pitch help an operator determine the type of target being followed. In use, the device emits sounds ranging from low grunts to high-C squeals, depending on whether it's tracing a crawling man or a speeding ambulance.

This model is also capable of differentiating between walking and running men, or between jeeps, tanks and trucks.

However, because the radar uses the doppler effect, it can detect only targets in motion.

The picture that hangs in midair

by Jeanne Reinert

A HOLOGRAM reconstruction (see back cover) gives an image so lifelike, the eye cannot tell it from the actual object. This laboratory device creates a color image you can see around as it floats suspended in the air.

Researchers in the field of holography are excited—it's such a new area that no one knows where it will lead.

They foresee the entire contents of the Library of Congress reduced to briefcase size, truly three-dimensional movies and television, magnifications of one million times, "true-to-life" contour maps and a new art form.

To prove this isn't daydreaming, they already have color pictures suspended in air, 3-D movies without glasses or gimmicks, vibrations you can see and measure, a code so secret it cannot be unraveled by interceptors and a device for measuring fog—all from hologram reconstructions.

Two decades ago, holography was the brainchild of Dennis Gabor of Britain's Imperial College of Science and Technology. Today, because of lasers, it has mushroomed.

Holography first gained fame as

"lensless photography" or "photography by laser" (see "Laser Revolution in 3-D Photography," Jan. '65), but it is more than photography. Just how much more depends on the money and ingenuity pumped into the field. Estimates on the present efforts range from 10 to 100 million dollars spent annually in 100 labs across the country.

Basic to holography is the idea of freezing light interference patterns in a moment of travel; then, at any convenient time, freeing them to continue their journey. As they are released from the hologram, the light waves recreate the scene just as it existed, although the objects have been removed.

The hologram itself does not contain a photographic negative. In fact, it looks like the formless pattern made by a sheer curtain billowing in front of a window screen—whorls, blobs and lines. Today, this is frequently put on the same emulsion as film in your camera, but there are other possibilities—thermoplastics, light-sensitive crystals.

The secret to holograms is orderly light waves. Ordinary white light, such as from electric lights or sunlight, consists of light waves of all lengths, hopelessly tangled together. Laser beams, however,

march along in regulated steps along the length of the beam, a characteristic called temporal coherence. Laser beams are not only orderly but are intense and can be focused to a sharp point, called spatial coherence.

Laser light can be compared to a marching band of blobs of putty. Each line of blobs is equidistant from the lines ahead of it and behind it. Another band of marching blobs intersects the first band at right angles. Every place the blobs run into one another, the two fuse into a doublesize blob, leaving vacancies in the lines.

If another band marches across the formation at a 45° angle, every partial collision will create a partially-increased blob with an empty space of corresponding size. A hologram simply freezes the action of the blobs at the interaction's peak.

As waves of laser light march outward in order and bounce off an object, another laser beam can cross the path of the bouncing waves and thereby cause a stationary interference pattern. The hologram records that still pattern.

If the object photographed is a tennis ball, the hologram is a series of concentric circles. If it is a small statue, the hologram will record exactly the way the statue scatters light waves, some bouncing off straight lines, some off circles and some scattering off angles.

Once the pattern is frozen on the hologram, it can be read out simply by reversing the process. A laser light is shown through the hologram

from the same spot as the recording beam; this recreates the object for the eyes in the original place and position (see Picture 2, back cover). The hologram, in effect a diffraction grating, reconstructs a real image on one side of the hologram and a virtual image on the other side. But the virtual image must be focused with a lens, whereas the real one can be seen without a lens.

Emmett Leith, head of the optics section of the U. of Michigan's Optics and Radar Lab, and Juris Upatnieks, a research engineer, made the first holograms using laser light and two-beam interferometry (light wave interference patterns). The latter technique ended the out-of-focus images that dogged other hologram setups.

Two 3-D horses, ■ hologram reconstruction, prance in the hands of Dr. A. K. Rigler.

Westinghouse



A color breakthrough came last winter when George Stroke, head of Michigan's Electro-Optics Lab, Keith Pennington and Lawrence Lin of Bell Telephone Labs rearranged the recording setup so that white light—a flashlight or the sun—can reconstruct a multicolor, laser-made hologram.

How far can you really see around a hologram? It depends on where the film is put. If it is a flat, large sheet, say 11 by 14 inches, you can see straight into it and as if around a corner on either side about 90 degrees. If the film is arranged in a circle, as Japanese researchers have done, you can see all sides of a scene.

Once you have a hologram, it's easy to duplicate by two methods. One is simply to cut the hologram into pieces, as many duplicates as you would need. Every part of the film contains the whole picture, as light from every point reaches every point on the film. This property is called ghost-imaging. However, details become more blurred as the hologram fragments grow smaller.

Another way to copy a hologram, explains Lin, is to put a fresh sheet of film next to a complete hologram and shine a laser light through it. The pattern is duplicated and only a little detail lost—about the same as duplicating a color transparency.

Holograms can be taken at two basic speeds, slow or superfast. The slow speed is an exposure with an argon or helium laser and using fine-lined film, Kodak 649 plates. This high-resolution film requires

With a hologram, you can see all sides of a projected object.

a long exposure to collect fine detail.

Exposures run from 10 seconds for a nickel to 10 minutes for an elaborate scene of five figurines. The subject must remain still to within a fraction of a wavelength, about one-millionth of an inch. Thus, all equipment is mounted on granite blocks to keep it from being moved by slight building vibrations or other disturbances. Naturally, live subjects are taboo under these circumstances. The alternative is a high-speed, ruby, Q-switched laser that can make two exposures within a thousandth of a second.

Lee Heflinger, Ralph Wueker and Robert Brooks, 3 physicists at TRW Systems in Redondo Beach, Calif., took holograms of the shock waves rippling after a high-velocity 22-caliber rifle bullet traveling at $2\frac{1}{2}$ times the speed of sound. When the holograms are reconstructed, the action of the bullet can be seen in 3D with great detail. This same technique has been used for two years in a radar installation in an airport to study fog and snow conditions. The setup is the first to allow depth studies of volumes.

Movies and television are alluring applications because so much optical information can be stored on a hologram, much more than on a photograph or microfilm.

First movies were devised at Stanford U. and others have been

made at Michigan's Radar and Optics Lab. In both places, however, emulsion is too thin to store a long movie of, say, five minutes. Leith, Upatnieks, Adam Kozma and N. Massey can store five or seven frames in a single hologram. Their movies show such actions as a pendulum swinging and a toy duck rocking back and forth. The sequence is jerky, something like a "Tom and Jerry" cartoon.

But if movies and television could be developed, just imagine sitting in your living room, surrounded by a televised, three-dimensional haunted house. Even if holographic TV does not reach the home, Stroke says he "is convinced the laboratory use of 3-D television will come."

Espionage uses

For James Bond fans, holograms can store military photos or plans so well that espionage experts could work day and night for 10 years without a breakthrough.

Leith and Upatnieks found that a diffuse material, such as ground glass or opal glass, can be put between the subject and hologram film. Then, to reconstruct the image, an identical diffuser must sit in exactly the same location. When light shines through the hologram, the diffuser and its image cancel one another out. The slightest change in position or substance, even an expansion by heat, will cause noise interference (optical equivalent to radio reception interference) to ruin the reconstruc-

tion. Even another piece of the same diffuser will wreck the reconstruction.

Leith explained that as the material is brought to within a few microns of its original position, the waves begin to rush into position, like a kaleidoscope. A hologram plus diffuser keeps its secrets except from those who know precisely how it was made.

The most practical, immediate use for the hologram is a test for the shudders and strains of vibration. Vibrations fascinate hi-fi fans and piano tuners. But they are headaches for airplane manufacturers, rocket and bridge designers.

Robert Powell and K. A. Haines of the U. of Michigan have found that vibration stresses can be made visible with holograms. They make holograms of a vibrating object. Because the hologram is an interference pattern, the wider the pattern, the greater the vibration. The hologram can be read for frequency amplitude of the vibration.

The hologram beats older methods of testing because fibers, mirrors or plastic materials need not touch the vibrating structure.

A similar application covers still mechanical parts that might subtly deform under strain. A hologram could be made of, for instance, a new disc. After it had rotated for a month, it would be put back in the same recording position and the original hologram superimposed. Interference patterns would reflect the amount of strain. If there was no strain, the image and the part

would coincide with one another.

"Probably the single most promising area," says Dr. Stroke, "is optical data processing, sometimes called optical character recognition. Behind that laborious label is the exciting possibility of putting the Library of Congress in ■ briefcase and being able to recall pages, one by one; or finding all the written references to 'radiation,' 'tektites' or '18th century cooking.'"

Fred Rotz, working with A. Vanderlugt and A. Klooster at Michigan, explained that the hologram method can record information in a transparency that is obscured by photographic methods. So-called "true complex matched filters" can be made from whatever information you want to recognize and retrieve later. For instance, you could make ordinary transparencies of ■ guide to gardening. Then you could make a filter for the word "daffodils." Each place the word "daffodils" appeared in the text as you went through the book, ■ light spot would signal the location of your reference word. Hooked up to electronic gear, it might unlock the puzzle of how to use computers for reference work, like automatically reading zip code numbers.

The researchers have been able to make filters that vary in selectivity. One filter, for instance, would only recognize a word in a serif type while another would recognize the word written in either serif or sans serif type. Several variations can be put on one filter. Also, the filters recognize a letter

even if it is poorly printed or slightly out of line. Computers that scan type cannot recognize either flaw.

There are other areas, some still barely touched upon by researchers. Stroke has just announced a holographic method of providing 100 times more light than now available with grating spectrographs. This would allow a telescopic photo of a distant galaxy to be made in 30 minutes instead of 50 hours. Telescopes could pry deeper into the sky.

With holography, there is the theoretical possibility of magnifications of one million times, but formidable technical problems will have to be overcome.

Holography can make exact contour maps; Percy Hildebrand and Kenneth Haines of Michigan have constructed contour maps of light bulbs. The technique could be used to copy precision tools.

In ■ look towards the future, Leith hopes for a day when some thick, light-sensitive material—perhaps crystal—can store thousands of holograms instead of today's seven or eight. Xerox Corp. recently announced a new thermoplastic material for holograms.

Even as it is, without further refinements, holography promises wonders. You could, for instance, see a collection of fine rubies and emeralds, not under glass case and guard, but just as they appear lying on a velvet cloth. One researcher foresees a whole new art form in holography, perhaps as revolutionary as photography was to painting. The day of real-life illusions is here.

TIPS AND TRENDS

NEW ARTHRITIS TREATMENT is indicated by research showing bacteria apparently cause one form of the disease (rheumatoid arthritis). Work at UC San Francisco Medical Center suggests that once bacteria are identified, antibiotics could cure the disease.

MISSILE BALANCE OF POWER is shifting. Reports say U.S.S.R. has built up ICBM force, may be planning strong force of antimissile missiles. U.S. answer, it's said, will be super-ICBM's to carry, not bigger warheads, but equipment to fool enemy defenses.

POTENT CHEMICAL LASERS are due in the next couple of years. Lasers will be energized by mixing chemicals with other materials, a method handy for use in space. The energy developed may also be sufficient to control thermonuclear reactions to produce power.

DON'T EXPECT OCEANOGRAPHIC MIRACLES. That is the warning of experts to those expecting quick riches from the sea. Why? Because of sea's hostile environment, legal unknowns of undersea rights and complexity of technology needed for suboceanic mining.

FOOD POINTERS: Beware danger of salmonella-poisoning in mass food processing. A study shows a high incidence in poultry foods. So cook them thoroughly.... Eat more meals and lose more weight. Women who consumed 200 calories five times a day lost over 9 lbs. in 12 weeks after other diets had failed.

THE ENGINEERING PICTURE



Goodbye to



Above: Two battery-powered miniature cars now being tested in London. Left is the "Scamp" and at right the "Trident," which operates on only two 12-volt batteries with a carbon pile regulator.

Right: Batteries in back of the "Scamp" electrical auto. Big advantage of the tiny autos is that they do not produce the smog-creating fumes that billow forth from more powerful gas-burning engines.

Left: Two-seat "Trident" is more compact than fast. Top speed: 35 m.p.h. But in modern urban traffic speed is neither necessary nor possible. On New York City streets cars move 8½ m.p.h. if they move at all.



All photos: Central Press

carbon monoxide

QUESTION: What kind of car did Donald Duck's grandmother drive?

Trivia experts should be able to recall Grandma Duck's old electric.

For a long time, Grandma Duck was about the only one driving an electric auto. Now that comic book car is beginning to look less funny.

In London recently, crowds





The "Scamp" makes the conventional small car look big. In the city, parking space is dearer than seating space, and the "Scamp" can park anywhere—almost, any way.

... and there's a dividend

stared at what may be a common sight in the future—tiny electric battery cars, threading in and out of the traffic.

As a city vehicle, the electric car offers a number of advantages:

First and foremost, it produces no exhaust fumes to add to a city's already dangerous blanket of air pollution.

Second, electrics are simple and cheap to operate. Instead of filling up with fuel, the cars are just plugged in. Manufacturers of the British electrics estimate that running cost would average about $\frac{1}{2}$ cent per mile.

Electric autos are not very fast, of course.

And present technology does not allow development of a battery-powered car that can cruise at turnpike speeds or go for 500 miles on

a single charge. But for urban transportation, who needs speed? It has been pointed out that over major arteries leading into New York City during rush hours, traffic moves at an average of 13 m.p.h. Once in the city, it slows to $8\frac{1}{2}$ m.p.h. You could do that in ■ battery-powered forklift truck.

Actually, Britain already has more than 40,000 battery-powered vehicles of one sort or another in operation. But they are all commercial vehicles, like milk delivery trucks. In the U.S., there are thousands of electric forklift trucks in factories and warehouses.

American battery manufacturers are worried by British work in the electric car field. After all, notes one industrialist, "The British beat us on the development of the jet engine and radar."



I see where they...

From the Editor's desk

... foresee the end of doctor-and-nurse teams in hospitals. They will be replaced by health-care teams of some 100 types of professionals and technicians. Medical and related scientific discoveries are so vast that physicians and nurses can't master them all and need the help of many new experts. All this means that the old cries of "Where's my nurse?" and "Get me a doctor" may be replaced by "Where's my cytotechnologist?" and "Is there an immunohematologist in the house?"

... have opened an ordnance factory whose daily output could fit into half a teaspoon. It's part of the Turtle Mountain ordnance plant at Rolla, N.D. It makes jewel bearings—pin-head-size drilled synthetic sapphire, ruby and tungsten carbide jewels—needed for the highly precise instruments of space, defense and avia-

tion. How many bearings fit in a teaspoon? About 25,000.

... predict lawns of plastic grass. Plastics pioneer Dr. Herman F. Mark says there'll even be houses molded in a matter of hours and roads cushioned by polymers.

... aren't through yet with sending monkeys into space. A 15-pound pigtailed monkey will swing into earth orbit next year for a 30-day study of his health. Tests showing changes in calcium and other primate urine constituents should indicate how an astronaut's metabolism might vary in space.

... plan to use sex to doom the boll-worm moth. Agriculture Department experts will try to eliminate the species, which damages the cotton boll, by baiting traps with a synthetic version of the chemical used by females to attract males.

THE ELECTRONICS STORY

This article is written in FASE



A NEW form of English will eliminate computer confusion about the relation of words in a sentence. The language, which was developed at Bell Telephone Laboratories, is called FASE for "Fundamentally Analyzable Simplified English."

Sentences in FASE can be easily parsed (resolved into parts of speech) by a computer. For this reason, FASE may eventually be the basis for information retrieval by machines in libraries and institutions which handle large numbers of written documents. For readers, FASE is indistinguishable from ordinary English. For example, this story is written entirely in FASE.

FASE was devised by Dr. Lee E. McMahon, who is a psychologist studying ways of improving com-

munications between computers and people. His work at Bell Labs is part of research in communications sciences—an area which includes the study of future communications networks which will handle messages between computers or between man and computer.

Dr. McMahon has reduced the English language to a strict form in which syntax (the orderly arrangement of a sentence) is clear and sentences are easily broken into component grammatical parts to avoid ambiguity. For example, "Time flies" would be ambiguous to a computer because the roles of the noun and verb are interchangeable. In addition to its popular interpretation, this expression could well be an imperative statement demanding that we clock the little insects.

However, a sentence in FASE strictly maintains the sequence of subject, verb and object; modifiers like adjectives and adverbs, and other parts of speech must fall into line. A complicated set of rules has been devised to ensure unambiguous syntax.

Consider "Time flies" again. A computer which reads FASE would interpret this correctly, since "time" would be taken as a noun. To demand that someone clock the

insects, we would have to rewrite the sentence. For example, we might say "Determine the speed of flies."

While syntactic ambiguity has been eliminated in FASE, problems arising from semantic ambiguity still must be overcome. For example, in "John throws a ball every night," it is not clear whether John likes athletics or parties.

Dr. McMahon believes that FASE is an adequate tool for communicating a broad range of ideas and that FASE can say anything which needs saying. Since long passages of FASE may produce a somewhat flat prose, the language is most useful for applications in which clarity of expression is preferable to an elegant style. For this reason, its immediate application would lie in the mechanical indexing of scientific abstracts or documents.

In a FASIC operation, abstracts or documents would be written or rewritten in FASE. They would then be punched on cards, and stored in a computer. The computer might then be instructed at any time to index or to retrieve information by a special program based on FASE grammar. These documents can be indexed and retrieved on the basis of grammatical units and relations which are not useful in present systems because of the syntactic ambiguity of natural English.

Dr. McMahon estimates that a competent writer of English would need a few months to learn how to

write FASE fluently. Instead of asking that writers and scientists learn the language, he suggests that specialists might be trained for writing or translating in libraries and centers for computer work, if the system is ever widely adopted.

Computer translation

FASE also may provide a more accurate computer translation of foreign languages. Automatic translation of foreign scientific papers is growing into a big business; but the results are not always reliable. Although present mechanical translation is based on grammar to an extent, it involves complicated series of computer decision-making. To some degree, these necessary complications compensate for inherent ambiguities in the language being used. FASE, which removes the syntactic ambiguities in English, would simplify the task of the computer and lessen the chance of error.



"That's what I said—It's
only a paper moon—!"

BOOK IN THE NEWS

Russia's un-Communist scientists



Fotochronika Tass

Modern highway leads from the science center of Siberia and apartment dwellings where over 30,000 people work and live.

THE scientific and technical elite of Russia chafe under the rigid policies of the Communist Party. That is the basic tenet of *The New Class Divided*, by Albert Parry (Macmillan, \$8.95).

The documentary report, heavily weighted with footnotes from Russian language source materials, tells a story that's hard to believe in these days of scientific sophistication.

Russian intellectuals in Stalin's time were sent to concentration camps or purged of heretical ideas by blood baths if they raised ■ voice

against the party line. The purges effectively silenced opposition and presented a remarkable show of agreement. They also outlawed several scientific theories, among them Einstein's theory of relativity and cybernetics (described as a "bourgeois pseudoscience" and, in 1953, "a sterile flower").

Until scientific minds prevailed in 1964, Lysenko's rejection of Mendel's theory (hereditary transmission of genetic characteristics) was the official party position. Disagreement with the party policy meant death from 1932 to 1949. For example, Nicholas Vavilov, "for years the guiding light of Russian biology and pride of the world's genetics," was sent to a concentration camp and death for his opposition.

With such severe punishment for disagreement, free discussion was unknown.

Parry follows the improved conditions under Khrushchev and the present leaders, all responsive to the needs of scientists and technicians and willing to concede to them much more freedom, even encouragement. In this historical context, Parry traces the changing conditions for members of the influential elite, group by group.

He makes a montage of beliefs gleaned from Russian journals,

newspapers, personal acquaintances and visitors' impressions, and draws parallels among different groups who have rejected the party principles.

In detail, he describes the methods and pleas scientists use to beg off the endless party indoctrination. They balk at being placed in charge of propaganda classes, claiming that their work requires too much time and energy. Students read newspapers, chat, refuse to pay attention during required indoctrination.

Parry cites example after example of apparently widespread flaunting of the spirit, if not the practices, of party policy among the middle leaders.

The grab for material wealth is substantiated by the vogue for dachas, or country homes, many of them built by managers and scientists, frequently with building materials desperately needed elsewhere. A foreman is caught stealing from his factory and protests that he gives much more to the state than he gets back; therefore, he says, he deserves the goods.

The author interprets these and many others such cases as symptomatic of the resurgence of a class society. He finds an erosion of the artificial barriers of the Communist doctrine of total equality and a reassertion of human nature.

The road to elite living, such as it is in Russia, is through technical education. Throughout the land, students strive for the one key that opens to them a better standard of living and personal prestige. Bright-

er students invariably go into engineering and science. Thus, Parry sees an emerging class with distinct influence.

He believes that the party needs the technicians and professional elite more than they need the party. Parry sees this as an erosion of the Communist Party and the burgeoning of an elite whose members are the haves in a havenot society: "A definite class society is in the beginning and is further developing, with sharp and growing cleavages between the menial and the mental workers." He sees the goals of this elite as a thirst for Western-style freedom, material betterment, pacifism and a compassion for the Soviet's downtrodden.

The author is a native Russian and chairman of the Department of Russian Studies of Colgate University.

—J.R.



BILL SHELLY

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PITY THE STUDENT

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Adolescent sex in America

IN 1963, an estimated 600,000 babies were born to girls 19 years of age or younger. One study of the number of pregnant adolescents in Washington, D.C., alone shows an increase of almost 30 percent in three years. These figures, and many others, indicate that the mores of the American adolescent, with regard to sexual behavior, are changing, at a breakneck pace.

To find the causes, effects and nature of the change, scientists of varied disciplines are now focussing their attention on the adolescent. Some particularly noteworthy material on the subject was presented at two recent scientific meetings: the Ciba Foundation's Symposium on Transcultural Psychiatry, and the New York Academy of Science's Conference on Pediatric and Adolescent Gynecology.

Adolescents today follow two major modes of living different from those of yesteryear, believes Dr. Martha Wolfenstein (Albert Einstein College of Medicine), speaker at the Ciba Symposium. They frequently initiate "sexual relations before the emergence of tender romantic feelings," and start new families "before material independence has been attained."

"Both these sequences reverse what has been considered appropriate until now." Other authorities support her view that an increasing number of adolescents engage in sexual activities before reaching emotional maturity. Speaking at the Academy Conference, Dr. R. A. H. Kinch of the University of

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Western Ontario, London, Canada, concluded that "by the age of 18, at least 25 percent of single girls will have already indulged in sexual intercourse."

There is evidence that even the physical pattern of adolescence is changing—a fact that, to some, accounts for the apparent changes in behavior. J. M. Tanner, in *Growth at Adolescence*, presented data showing a biological trend for earlier occurrence of puberty. Dr. Wolfenstein does not believe that this factor alone is responsible for the pattern of earlier sex relations, however, since "traditionally in our culture the attainment of puberty did not immediately precipitate sexual relations. . . ."

Pregnancies increasing

Correspondingly, and somewhat surprisingly in these days of improved contraceptive measures, the number of pregnant adolescents per year also seems to be increasing. Another speaker at the Academy Conference, Dr. John F. J. Clark (Howard University School of Medicine), in a paper dealing with obstetrical problems encountered in teenage pregnancy, cited these statistics for Washington, D.C.: "In 1962, out of 19,950 deliveries, there were 739 adolescent patients; in 1963, out of 19,845 deliveries, 889 were adolescents; and in 1964, out of 19,001 deliveries, 952 were adolescents."

What has happened to the adolescent in America to cause such an

increase? What changes in mores are playing a role here? Renowned anthropologist Dr. Margaret Mead, participant at the Ciba Symposium, ventured a suggestion: "We used to talk about a shot-gun wedding when the shot-gun was in the hands of the girl's father. Today we have an incredible number of shot-gun weddings with the shot-gun in the hands of the children. Pregnancy today is used as a way of persuading the parents to agree to a marriage. The parents do this willingly, with the customary celebrations and then support the young couple financially after they are married."

Dr. Wolfenstein believes the teenager's current view of sex is negating an old cultural tradition in our society: that romantic love, or tender sentiment, should be present before sexual relations. She comments: "In [the] older Chinese culture, for example, a couple whose marriage had been arranged hardly saw each other before they came to the marriage bed. We are told that deep feelings of mutual affection and respect frequently developed subsequently between the partners. In our culture, however, courtship and sentimental intimacy have served as necessary sanctions for a sexual relation. It is an important question whether we can reverse the sequence of sentiment and sex in Anglo-American culture."

The apparent fact that adolescents are having sexual relations earlier, and often unaccompanied by tender sentiment, is not a healthy sign, according to Dr. Wolf-

Shot-gun weddings are on the rise, but children hold the shot-gun.

enstein. "Where sexual acts are performed in advance of emotional readiness, and where the tradition has been that they should be preceded by such readiness, there is the risk of loss of affect with the related disturbances of depersonalization and derealization."

There are numerous events, in this century, that have contributed to a change in sexual mores. Dr. Wolfenstein notes the fact that two world wars led people to believe that tomorrow may never come, and that it is more important to live fully in the moment.

The economic factor is no less significant. Whereas in the past a man may have been quite capable of supporting a family after graduation from high school, now much higher education is necessary for economic security. It is not uncommon for a student to rush into marriage confident that he will be sent through school by his parents, his wife or his wife's parents. It is rarely suggested that he leave his studies to support his family, for his parents want high status for their son, his wife wants future economic security, and his wife's parents are concerned for the status of their daughter.

Dr. Wolfenstein feels that the changing morals of the adolescent are partly due to those of the parents themselves, whose economic

security was shaken by the Depression. At that time, long-term plans and postponements of marriage until economic independence was attained came to seem meaningless. In the light of this experience, members of the older generation are often reluctant to ask their young people to work and save to attain a life like their own.

Parents today are reluctant to impose restrictions of any kind upon their children, according to Dr. Wolfenstein. They often tend to see youth, not as a transitional phase, but as the prime of life. Teenagers, for their part, have contributed to a lack of rapport with their parents by devising their own standards, modes and language—all of which make adults feel somewhat like outsiders.

Recognizing the fact that there is a disturbing period when a teenager is physically but not emotionally mature, speakers at both the Ciba Symposium and the Academy Conference attempted to find some means of defining for the adolescent his role in society. Dr. M. Fortes, participant at the Ciba Symposium, and on the Faculty of Archaeology and Anthropology, Cambridge, feels that some sort of initiation ceremony into adolescence would be beneficial. His students have suggested to him that such a ceremony would help them feel that

society was taking them seriously and giving them their rightful place in the community. They complained that they lack a feeling of "before" and "after" in relation to reaching maturity. Dr. Fortes points out an additional advantage to such a rite: "In the parts of Africa that I know, the people make a very clear distinction between what they call 'play sex' and 'real sex.' Play 'sex' is suitable for children, but real sex is for the serious purpose of procreation, for marriage, having a family, and building your place in society."

Initiation rites

Dr. Margaret Mead, discussing Dr. Fortes's suggestion, points out that there already exist, albeit informally, many different types of initiation rites in the United States. She cites initiations into fraternities and delinquent gangs as examples, plus a strange new type of rite: "There is also an increasing number of girls who have sought to be deflowered by a stranger, a rite that is well known in primitive societies. The girls pick someone who is either a stranger or of no importance to them, and use this intercourse as a ritual protection for what will happen later, more and more to them."

The nebulous concept of "improved sex education" has often been seen as a cure-all for teenage problems. Dr. Kinch, speaking at the Academy conference, effectively dispelled this myth. "Adequate

knowledge of sex with guideposts as to behavior might act as a prophylactic against teenage pregnancies and venereal disease," he declared, "but it is doubtful."

Old fears outmoded

In the past, it was thought by some that sexual behavior could be influenced by instilling fear of dire consequences, such as "conception, infection and detection", into the young person. All of these consequences, Dr. Kinch noted, are outmoded today. "Every intelligent adolescent with a rightful access to a library, knows that pregnancy can be reliably prevented, and he or she also knows that venereal disease can be easily cured." Moreover, "the automobile and urban living makes isolation and anonymity possible. Public opinion is also less oppressive."

Physicians, he believes, are best qualified to teach sex education courses, not only because of their extensive knowledge, but also because they are very likely to be at ease. Instruction should "encompass the anatomy and physiology of sex and the psychology of sexuality. The problems of sex attraction, extramarital pregnancy, and its avoidance, should be integrated into the general health education course." He advises: "Place the information before them, point out alternatives and problems and . . . hope that in his own environment this young person will make the right decision."



Goblet or profiles? Which do you see?



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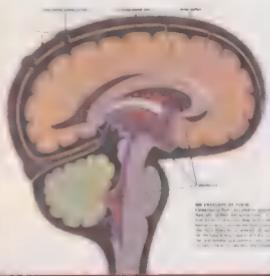
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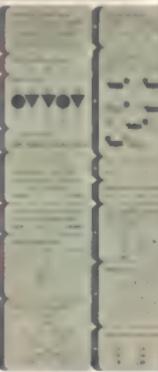
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Imaginary heart disease

At least half of America's 15 million heart sufferers do not really have an organic disease. They are cardiac neurotics and represent one of today's most vexing medical problems.

by William Kitay

"Doc, I just can't seem to catch my breath."

"I get this funny pain on the left side of my chest."

"I was falling asleep when suddenly my heart started to flutter and to skip around."

Of all complaints that patients have, physicians dread hearing these three most of all. For invariably, a patient with one of these symptoms has come to his own conclusion: "It must be my heart."

The patient believes that there is something wrong with his heart. The physician knows that none of these symptoms is in itself a sign of heart trouble.

The physician is afraid that anything he may say to convince his patient that his heart is sound, will have just the opposite effect. It may even lead to the develop-

ment of one of the most common heart ailments today—iatrogenic heart disease.

Iatrogenic heart disease is a psychosomatic disorder induced in a patient when a physician unintentionally confirms his fear that he has heart trouble. It may be caused by an innocent remark such as: "Everything is fine, just take it easy." Or it may be brought on by the intensity with which the physician listens to the heart.

Iatrogenic heart disease is a term most physicians would like to forget. It is not that they deny that this form of heart disease exists. But they do insist that there is growing evidence that a heart ailment can not be directly caused by a physician's chance remark or facial grimace. When this appears to be the case, it is because the patient already has convinced himself that he has heart disease. The

physician, unwittingly and unknowingly, plays a supporting role to a *fait accompli*.

"In such instances," says heart specialist Dr. A. D. Hart, "cardiac symptoms were present long before the patient may have even seen the physician."

The symptoms these people complain of resemble those that are commonly associated with heart disease. Their origin, however, is not in the heart or the circulatory system, but in the patient's mind. These people are suffering not from heart disease, but from a problem of another sort—cardiac neurosis.

No disease at all

It is estimated that about 15 million persons in the United States or 50 percent of today's heart sufferers are cardiac neurotics, persons who do not really have organic heart disease. Some physicians put the figure closer to 60 percent. Heart specialist Dr. Peter Steinrohn says that, in his 30 years of practice, he has found that three out of four people who come to him complaining that they have heart disease, have no heart disease at all. Many cardiac neurotics are not older people who would be expected to be concerned with their hearts, but younger people between the ages of 20 and 40. Most are not men either, the traditional victims of heart disease, but women.

While a cardiac neurosis is not a threat to life as is heart disease, in terms of lost wages and lost time

from work, it is as important. Many cardiac neurotics are self-imposed invalids, restricting their activities and eventually becoming a burden to their families. Some become public charges, being supported by state and community welfare funds and by federal disability pensions.

Dr. John W. Keyes of the Henry Ford Hospital in Detroit, describes cardiac neurosis this way:

"Fear of heart disease or fear of death due to heart disease, is one of the major manifestations of neurosis. It very often occurs in a person who is emotionally disturbed and who has other phobias."

When such a person experiences a symptom that he associates with his heart, Dr. Keyes explains, it becomes a part of a vicious cycle which is strong enough to convince the patient that he really has heart disease. All he desires now, and with many cardiac neurotics it becomes an obsession, is to have a physician confirm his conviction.

It is the chronic worrier who most commonly becomes a victim of cardiac neurosis. The ever present burden of anxiety that he carries within him predisposes him to it.

The three most common precipitating causes of anxiety about the heart are:

1. A dramatic case of heart disease, perhaps with sudden death, involving a relative or a friend, especially if there had been a close contact with the ill person.

2. A prolonged emotional experience which may cause some symptom commonly associated with

Cardiac neurotics look for a doctor who will confirm their worst fears.

heart disease, such as a heart flutter.

3. Tension resulting from some personal problem and causing chest pain, a rapid heart beat or a shortness of breath.

The most prominent symptoms that are characteristic of a cardiac neurosis are: Sharp pains felt on the left side of the chest, consciousness of the action of the heart, difficulty in breathing, dizziness and fatigue.

In cardiac neurosis, chest pains usually occur after an unpleasant experience. The pain is muscular in nature and is felt on the left side of the chest where the heart is commonly believed to be. Actually, the heart is located in the center of the chest. In true heart disease, such as in angina pectoris, chest pain is felt over a broad area, generally while the person is at rest, and usually after an exciting but pleasant experience.

Descriptive terms used

Being aware of the action of the heart is also common. The heart action often is described by the cardiac neurotic as a pounding of the heart, a heart beat loud enough to hear, a rapid heart beat, an irregular heart beat, a fluttering heart or a heart that seems to flop over each time it beats.

The cardiac neurotic usually

becomes aware of these symptoms at night while lying in bed, trying to fall asleep. The quieter the room, the more aware he is of his beating heart. The experience can be quite frightening and the neurotic finds himself fighting sleep, afraid that if he dozes off he will never awaken again. Some develop insomnia, become exhausted and fatigued and lose interest in their work and in almost everything but their hearts.

Case histories show that being conscious of the action of the heart is due to emotional situations. The symptoms are easily sparked by tension. As a rule, they just as readily disappear during physical activity associated with pleasure. In some individuals, palpitation of the heart may be due to extrasystoles, harmless skips of the heart due to its premature contraction.

Difficult or labored breathing is not a major complaint of the cardiac neurotic. However, most every neurotic mentions it, usually describing the symptom as "being out of breath." Some insist they are unable to get sufficient air into their lungs, and that they must take an extra deep breath now and then to catch up. The added air causes light headedness or dizziness which is erroneously taken as a sign of poor or impaired circulation and thus, of heart disease. A large amount of air, forcefully inhaled, also must be forcefully exhaled.

This produces the long sigh so often associated with the cardiac neurotic.

Shortness of breath is part of the cycle of symptoms in the cardiac neurotic. Emotional distress, in these people, causes chronic fatigue and general exhaustion which, in turn, lead to exertion and to a shortness of breath. Being short of breath increases the anxiety the person has about his heart, thus bringing on additional emotional distress. In some people, a shortness of breath is due to obesity, a cause that is often overlooked.

The cardiac neurotic can suffer pronounced fatigue in the morning. He improves during the day as he becomes involved in activities that take his mind off himself. These symptoms often disappear completely when the activity is enjoyable. As anxiety returns, towards evening, fatigue and exhaustion recur. Prolonged sleep and rest offer no relief.

Distressing as these symptoms may be, Dr. George Burch of the Tulane University School of Medicine has found that many cardiac neurotics welcome their supposed heart trouble. These people, he says, utilize their symptoms as part of an elaborate escape mechanism from their psychological difficulties, a finding that has been borne out in a study by Dr. William N. Chambers of the Dartmouth University School of Medicine.

"The patients with cardiac neurosis," says Dr. Chambers, "showed a high degree of secondary gain. In some, the pain represented a

mechanism for setting limits to their activities and freed them temporarily from intense pressures or responsibilities. It seems to act as a means of getting attention and of controlling immediate members of the family. In others, the pain represented an acceptable excuse for failing to attain life objectives."

In about 25 percent of the patients he studied, Dr. Chambers found that monetary compensation was part of the neurosis. These were people who had been discharged from military service and given a disability pension because of their complaints of chest pains and a diagnosis of suspected heart disease.

Many, when told they did not have heart disease, continued visiting doctor after doctor until they found one who agreed with them.

Treatment a struggle

Treating the cardiac neurotic is no easy matter. It becomes a struggle between the patient and his doctor. The neurotic is not prepared to accept the doctor's assurance that there is nothing wrong with his heart, and every doctor does not have the knack of being able to impress the truth upon the patient. What tends to complicate matters is that the physician is aware that the patient is alert to anything he may or may not say or do that can be interpreted as confirming the presence of heart disease.

Some physicians do not go be-

A cardiac neurotic will often lose interest in everything but his heart.

yond the simple reassurance that everything is all right. Others prescribe mild tranquilizers in the hope that calming the patient may help lessen his anxieties, and thus also his overconcern with his heart. Some become weary of trying to cope with these patients and refer them to another doctor or to a clinic, a move that only aggravates the neurosis.

Heart specialists agree that the successful treatment of the cardiac neurotic lies in recognizing the fact that he is an emotionally distressed individual. Before anything else is done, the physician must establish the cause of the patient's neurosis and initiate every effort possible to alleviate it.

With the patient's anxiety under control, the physician institutes a thorough medical and cardiovascular survey, one designed to detect any and every physical problem. Extensive laboratory tests and diagnostic instrumental devices are used. The physician's aim is to convince the patient that the diagnosis he will render will be based on sufficient, reliable and irrefutable data.

After emphatically reassuring the patient that his heart is sound, the physician seeks to convince the patient that his symptoms are not caused by any disease of the heart, but by fear and that the symptoms, no matter how distressing, are not

in any way jeopardizing his life.

A cardiac neurosis is not difficult to diagnose and, in most instances, the ailment can be managed successfully and its symptoms effectively reversed. The challenge that faces the physician is in recognizing the one complicating factor that may counteract whatever good he may accomplish—iatrogenic heart disease.

Doctors' diplomacy

Thus, the physician must be constantly on his guard against any misinterpretations his cardiac neurotic patients may make of any innocuous statement of his. He must be extremely careful not to make any ill-considered remarks or use any mannerism that might weaken their confidence in him or give the neurotic cause to doubt and so to wonder about his original fears about his heart.

In all probability, physicians will not completely be able to prevent iatrogenic effects from happening. But one thing is sure: The number of heart sufferers in this country could be cut in half if cardiac neurotics would only believe their doctors and be grateful for his finding that their heart is normal. They might well take to heart Dr. Steinicrohn's recent admonition: "Life is too short to throw it away on imaginary heart trouble."



What to do

by Eileen Crimmin

"CAUGHT in a forest fire? Who? Me? Never!"

Don't scoff. If you drive a car anywhere near the nation's tree-growing areas, you can find yourself on the edge or in the middle of a forest fire.

Nor are tree fires limited to western or northern forests. We have timber stands in all but the plains states. And even these have an equivalent fire in grass and brush fires that sweep the prairies.

Forest fire loss of human life per acre destroyed is relatively small. But loss of wild life is appalling and timber resource dollar loss is immeasurable except in a direct stand-per-acre figure.

Both lightning and spontaneous combustion can cause forest fires, but man is the major culprit, with his careless disposal of lighted cigarettes and hot matches, machinery sparks, explosions and unattended or improperly extinguished work fires.

Forest fires occur in all shapes, sizes and speeds, but the "normal" one consumes trees from bottom to top, destroying ground cover at the same time.

It travels with the wind at a speed determined by wind velocity plus dryness of the area, density and kind of timber. Since a very hot fire can create smaller wind cycles within the general wind pat-

in a forest fire

tern, portions of a fire may not progress at predicted speeds or in predicted directions. This fact plus sudden wind shifts pose the greatest danger to occupants of a fire area.

A lesser but equally destructive fire is the low-level brush fire, which chars tree trunks and scorches lower branches but leaves trees relatively intact. This removal of ground cover jeopardizes the area's entire ecology while low-level trunk damage often kills the trees anyway.

The famed frightening "crown" fire rushes with locomotive speed and sound through only tree tops, literally to decapitate a forest with flame. Crown fires often become a general fire as flaming branches fall and ignite lower foliage and ground cover.

What can you do if caught in a fire area? "Get out of there fast," is the order of every ranger, lumberman and fire fighter experienced with forest fires.

Alerted for danger

This means (1) get out of the fire area even though it presently doesn't threaten you and (2) follow detour instructions without complaint if flagged down during highway travel.

When vacationing, keep alert for forest fire danger by listening to radio news, checking the sky for concentrated smoke or diffused

smoke palls, and noting Fire Danger billboards erected by the Forest Service or lumber firms.

When traveling, if caught by a sudden fire and ordered to the fire line, comply. Forest Service officers have legal power to impress able-bodied males of legal age into fire-fighting duty! This should give you some idea of how vital is fire control and stoppage.

Survival methods

Self-preservation in a forest fire depends entirely upon your situation and activity. For instance, forest residents are evacuated when possible. That failing, they must depend upon the cleared area around their buildings to protect them, plus storage of water for personal safety and use of water supply to fight flame threats carried by wind.

If camping, hiking or driving, get to the lee side of the wind carrying the fire and, when possible, move at right angles out of the fire's path. Don't try to outrun any fire in the direction it's taking.

If you can't get away, search for open places to wait it out—a meadow, lake, rock slide, blighted area, plowed field. Remember, dirt will not burn, so any area devoid of vegetation increases your safety, for example, sandy beaches or river banks, power or phone-line breaks,

roads, highways, especially super-highways.

Heat, reather than flame, is your greatest enemy. You need to cool the air you breathe, and to keep your skin moist.

Therefore, when caught outdoors on foot, a lake or river offers best protection. Any source of water is better than none. If boat or raft is available, get to middle of lakes. If not, wade into streams and rivers as far as possible. If bottom is precipitous, lie flat in water's edge, or hold fast to rock cliffs as you seek a less steep shore.

Keep cool

Stay submerged and repeatedly duck head under. Keeping head cool is vital. Breathe air just above water surface. Prepare for a long stay if timber is dense. Don't get discouraged, don't get up and run and don't drown, either.

Heat, noise and sight are terrifying, but hundreds before you have survived fires in just this manner.

If caught with only a meadow or rock-slide refuge, heat and smoke-fouled air are your greatest enemies. Heat rises, so lie flat face down, cover head as thoroughly as possible (with wet material if possible) to keep out heat and filter air. Breathe with nose against the ground.

In a meadow refuge, remember that the meadow grass probably will fire. If possible, dig up a large area where you will lie. If not pos-

sible, pull up the grass around you, or mat it by stamping it down. Do anything that will deprive flame of fuel in your immediate area.

When meadow grass fires due to intense heat, your clothing may do likewise. Roll slowly back and forth, one complete revolution each way, keeping head covered. This deprives flame of oxygen and will smother both clothing fire and grass flaming near you.

Don't despair at this occurrence, because this bursting flame burns out or moves on in a matter of seconds, which seems like hours to you. DO NOT sit up to put out flame. DO NOT panic and run. Just roll and resolve to bear what singes you must endure.

If you are caught afoot directly within a forest fire, your best chance of survival is to reach an already burned area even if it's still smoldering. No fire advances in a 180-degree straight line of flame. A long finger slashes forward here, a grove bursts into flame there, and on the whole a very jagged line of fire is created.

Cover nose, mouth

It's possible to penetrate this line by making a dash from an unburned area into a burned area if you can select a relatively thin fire front. You can cover nose and mouth, keep low and pick your way through a sparse grove that may still be aflame. But this takes great courage and presence of mind and it can be done only where trees are

If caught within a forest fire, go to an area that's already burned

not dense and ground cover not thick. Nobody can dash through fire in thick evergreen stands where the entire fire line may be a mile deep.

Abandoned mine shafts and natural rock caves also have saved persons trapped by forest fires. But unless you know the area, finding these is pure luck. Nevertheless, as ■ last resort, it is better to wedge oneself against a rock cliff that won't burn than to keep beating a fruitless path through dense underbrush that will.

Smoke jumpers often are equipped with a quilted asbestos survival tent. The Forest Service reports that it works, even though heat is intense and the person thus saved is pretty miserable. But better miserable than dead. Readers who frequent forests afoot in fire season are advised to investigate this piece of specialty equipment.

The best way to avoid a forest fire is not to let one start. Don't you start one. Don't let anybody near you start one, either. Report any you find. Stub cigarettes out in ash trays or drown in water. Ditto matches. If neither trays nor water is available, stub cigarette embers against shoe or rock, destroy remainder by pulling tobacco apart and scattering. Ditto matches, and destroy warm head, then break remaining shaft.

Put out all forest-stove fires be-

fore leaving them. Use dirt, water or sand, then clean out fire box for next user.

Put out ground fires with dirt or water; then scatter ashes and douse again; then DIG UP ground beneath fire bed and douse subsurface embers. Numerous fires continue in underground humus or smolder along decayed roots for many yards, often for many days, then suddenly find tinder fuel and burst into full flame long after original surface fire was extinguished.

"Green gold," our forests are called. When they die by fire it's called the "great death," because destruction is so complete and re-growth often never takes place.

You are urged neither to cause nor become part of this great death.



"Have you noticed any other side effects?"



University of Chicago photo

Your hidden life asleep

Science has begun to explore the unique, unknown state of consciousness in which we spend a third of our lives.

EACh night at an accustomed time, people begin to set the stage for sleep with small rituals that lead to bed and darkness.

For seven or eight hours a person seems to have departed, gone from the world into a silent internal communion—with what?

Sleep, as we now know it, is not a state of unconsciousness, an oblivion punctuated by occasional dreams. It is not, indeed, a unitary state of being, but a progression of rhythmic cycles representing dif-

ferent phases of neural function.

The progression of cycles have been pieced together by numerous observers through nightlong vigils in sleep laboratories. There are perhaps two dozen sleep laboratories in the United States, mostly in university buildings and hospitals.

In the control room, the visitor will notice the fundamental polygraph instruments, consolidated in the big amplifier system, and the electroencephalograph machine, a device through which researchers can watch brain activity. Small conductive electrodes—bits of metal pasted onto the scalp—or in some cases, needles implanted in the brain, transmit the natural beat of a brain region through changes

Excerpted from "Current Research on Sleep and Dreams," U. S. Dept. of Health, Education and Welfare Public Health Service publication No. 1389. Written by Mrs. Gay Gaer Luce, with the consulting aid of Dr. Dennis McGinty. The effort was coordinated by Dr. Julius Segal and his staff of the Program Analysis Section, Research Grants Branch, National Institute of Mental Health.

CURRENT RESEARCH REVEALS:

- 1. The five kinds of sleep**
- 2. What drugs and alcohol do**
- 3. The danger of people who sleep while "awake"**
- 4. Who dreams about what**
- 5. How sleep studies can teach mind control**
- 6. Why death can come in sleep**
- 7. The difference between the dreams
that men and women have**

of electric potential. The electroencephalograph (EEG) amplifies these shifts in potential, transmitting them to magnetic tape or driving a row of ink pens on the desk-like panel of the machine.

Each pen, driven by a signal from a part of the brain, moves up when the electric charge is negative and down when the charge becomes positive. As a continuous sheet of graph paper moves forward on a roller under the oscillating pens, the up-and-down pen movements are traced out as waves—brain waves. Their amplitude indicates the ever shifting amount of voltage generated in a brain region, and their shape can indicate the speed of the electrical changes within.

Typically, the sleep lab volunteer will arrive before 10 p.m., change into pajamas, and seat himself in some corner of the laboratory to have electrodes pasted on.

About 11 p.m., the volunteer will be relaxed. His body temperature is declining. His eyes are closed, and he is no longer moving. On the graph paper in the control room,

the jumble of rapid, irregular brain waves is beginning to form a new pattern, a regular rhythm known as the alpha rhythm. This pattern of 9-12 cycles a second indicates relaxed wakefulness. Subjectively, it is a serene and pleasant state, devoid of deliberate thought, into which images may float. A moment of tension or attempt to solve a mental problem will disrupt it.

In stage 1, another pattern begins to emerge on the EEG paper. This new script is smaller, indicating lower voltages. It is uneven, desynchronized, and it changes swiftly. At this point one may experience a floating sensation, drifting with idle images as the alpha rhythm gives way to the low voltage, fast irregular rhythm of the first stage of sleep. The volunteer, in this phase, can be easily awakened by a noise or a spoken word. His body muscles are relaxing. Respiration is growing more even and heart rate is becoming slower.

In stage 2, the script grows larger and the pens trace out quick bursts known as spindles, rapid crescendos



*Awakened during REM sleep,
a person will usually report
the often bizarre mentation
generally recognized as a dream.*

and decrescendos of waves. The eyes of the volunteer may appear to be slowly rolling. He is quite soundly asleep, yet it is not hard to awaken him.

By now, there has been a fundamental change in his brain function. One aspect of this change is suggested by a study in which volunteers slept with their eyes half open; illuminated objects were suspended before their eyes. On the whole they were not awakened by the light, nor did they remember seeing anything, but when awakened by a voice a few seconds later, they often insisted they had been wide awake and thinking thoughts that, as narrated, had a vague and dreamlike quality. Left undisturbed, however, a person will soon descend into another level of sleep.

In stage 3, the spindle bursts and somewhat irregular brain wave rhythm begins to be interspersed with large slow waves. Now it will take a louder noise to awaken the sleeper, perhaps a repetition of his name. His muscles are very relaxed. He breathes evenly, and his heart

rate continues to slow down. His blood pressure is falling, and his temperature continues to decline. Innocuous sensory events are making almost no impression.

Stage 4 might be called a most oblivious sleep. The muscles are very relaxed, and the person rarely moves. It is hard to awaken him with the low noise or buzzer that would have aroused him earlier. His heart rate and temperature are still declining, and his respiration is slow and even.

A normal person will spend a considerable portion of the night in this stage, especially if he has lost sleep. If annoyed from outside, he will tend to drift into a lighter phase of sleep, but if annoyances prevent him from spending a certain portion of his night in stage 4, on subsequent nights he will make it up by spending substantially more time in stage 4.

About an hour or so after falling asleep, the sleeper may begin to drift back up into the lighter phases of sleep. Roughly 90 minutes have passed, and the volunteer's sleep

has resumed the pattern of stage 2.

Now, suddenly, the pens of the EEG begin to jabber, scratching out wild oscillations. He has turned over in bed. As the oscillations die away, the brain wave record shows an irregular low-voltage, rapidly changing script like that of stage 1.

Now two pens that are activated by movements of the eyes make rapid darts, as if the eyes had turned to look at something. Intermittently the pens continue. The eyes move as if following a film. These rapid eye movements, known as REMs, signal a phase of vivid dreaming, a most unique state of consciousness.

Awakened during REM sleep, a person will almost inevitably report mentation that differs from waking thought, dramatic and often bizarre, generally recognized as a dream. Yet, if he is awakened a few minutes after the rapid eye movements cease, when he has lapsed into another phase of sleep, the dream will have evaporated. The average individual spends a total of about five years of his life in such vivid dreaming, but for the most part he is amnesic, remembering very little.

It has been said that the average adult dreams about every 90 minutes, and that the full cycle of sleep stages spans an interval of 90-120 minutes. This generalization is somewhat misleading, for dreaming, dreamlike experiences, fragments, images and mentation occur in all phases of sleep, although recall varies. Sleep is a succession of re-

peated cycles. Nevertheless, people of about the same age do not follow a rigid timetable of sleep, and all humanity does not rise and fall on the waves of a single tide.

Still, however much people differ in detail, normal people show roughly the same overall pattern. They sleep for a long interval once in 24 hours, at the time of their lowest body temperature. They spend roughly the same proportion of the night in REM sleep and stage 4, distributing them over the night in roughly the same manner.

Is sleep necessary?

Must we sleep? Is sleep an integral part of our organic rhythms, our metabolism?

One useful procedure for exploring body needs is to deprive—take away sleep and see what happens. In the 1950's, a large number of volunteers underwent periods of sleep starvation in laboratories where they were measured for physiological and chemical changes, their ability to perform tasks, and where their psychological changes were under continuous scrutiny.

Studies performed at the Walter Reed Army Institute of Research, largely by Dr. Harold L. Williams and his associates, have told a discouraging story about a person's performance during prolonged wakefulness.

One of the most consistent observations was the progressive unevenness of mental functioning, lapses in attention, growing fatigue, weariness,

ness, and a tendency to withdraw from the outside world.

People began to make fewer and fewer unnecessary movements, and showed some confusion between their own thoughts and external events. Certain bodily sensations began to develop. A tightness around the head gave the impression that a hat was being worn.

Many complained that their eyes burned or itched and their vision was blurred; after 30-60 hours of sleeplessness people had difficulty with depth perception. Small objects seemed to dart out of place, and chairs apparently changed size. Commonly, lights seemed to wear a halo of fog. Even the floor seemed to undulate. After 90 hours, some people developed vivid hallucinations. Brief dreams would intrude and become confused with reality, and people found their time sense distorted.

If the sleep-loss is protracted beyond 100 or 200 hours, however, it appears that the symptoms intensify and begin to resemble psychosis. The fifth day has seemed to be a turning point in a number of cases observed.

At present, we have no way of determining what changes caused by sleep loss may leave a subtle, lifelong effect, perhaps even a chain reaction, enhancing disease, perhaps shortening the life span. Animal and human studies have indicated some of the physiological changes that occur when sleep is prevented for long intervals.

Several studies suggest that the

body metabolism suffers difficulty during prolonged wakefulness, and these suggest one of the ways in which normal sleep may be regulated. The body appears to be governed by internal clocks, intermeshed systems of biochemical change that we call metabolism.

One of the cycles we have come to recognize is a diurnal rhythm of rising and falling temperature in man. In the Walter Reed studies, oral temperatures were taken during a 98-hour period of sleep deprivation, and it was clear that the diurnal rhythm remained. Indeed, people felt most sleepy and tired at the time when their temperatures were lowest. In addition, during the progressive sleep loss, the overall body temperature declined somewhat. Perhaps this was an indication of a declining metabolism, a progressive inability to produce energy.

Sleep-loss delirium

A biochemical study of two sleep-starved volunteers—one wakeful for 5 days, the other for 10 days—suggests that biochemical mobilization of energy changes considerably after 4 or 5 days without sleep. This may account for the pathological symptoms and delirium that have been observed after 5 days of sleep loss.

Sleeping on one's feet is no myth. Where long vigils are essential—as perhaps in a space trip, or a military operation—it seems clear that self-paced tasks, group tasks



*After 90 hours without sleep,
volunteers began to experience
hallucinations, as dreams
became confused with reality.*

with inherent competition, and high incentive tasks are to be preferred over sentry duties, surveillance or monitoring for sleep-starved personnel. Increasingly frequent microsleeps, the influence of the temperature cycle, and evidence for a rhythmic occurrence of dreamlike intrusion in 90-120 minute intervals provide some new guidelines by which we can now design the tasks and work schedules of people on long and sleepless duties.

The healthy, the fortunate, succumb to sleep casually, accepting it as naturally as breath, enjoying a respite from worry, grief or pain, and awaken refreshed.

The inability to sleep, or stay awake, or a disorder in the recurrent cycle of sleep can become a torment and disrupt a life with appalling speed. Sleep disorders can alter a person's mood and behavior to a degree that is often ignored, and mood, activity and environment play their part in altering sleep.

A number of laboratories have seen instances of "wakefulness" during which people were actually sleeping. Imaginary insomnia is no

joke to the person who exacerbates his problem by growing tense over his supposed inability to sleep. Subjective insomnia may, in some cases, reflect a subtle sleep disorder that has nothing to do with insomnia, strictly speaking, but may instead reflect an unstable shifting of the nightly sleep pattern.

Because sleep disorders and mental illnesses almost inevitably occur in concert, sleep disorders have become a cue for clinicians in discriminating between similar forms of mental illness. If typed by sleep symptoms, depressed patients, for instance, appear to fall into three distinct categories. Some people oversleep in what we have often dubbed escapism. Others become too anxious and agitated to fall asleep at night. Still others fall asleep easily but awaken too early.

Most people know about insomnia but they have never heard of narcolepsy. Although this curious ailment had the status of an extremely rare illness until recently, it may not be rare at all, for many people endure its symptoms without having a name to call them.

Narcolepsy is characterized by a



Scientists hoped LSD-25 would increase dreamtime. Instead, it was so arousing that subjects were unable to sleep.

tendency to fall asleep easily and at inappropriate moments. Before their problems were diagnosed, a number of narcoleptics have fallen asleep at the wheel of a car and crashed into a building or tree. A frightening symptom of many narcoleptics is an overwhelming, swoon-like reaction to intense emotion.

Violent anger or laughter literally makes them weak with emotion, and they may lose all muscle tension, falling to the floor and sometimes into a brief sleep that resembles a blackout. This cataplexy afflicts about 60 percent of the narcoleptics. Sleep paralysis is another disturbing symptom; narcoleptics have reported awakening but being unable to move for some minutes.

There is no way of knowing how many Americans suffer from narcolepsy, nor how many industrial or auto accidents are caused by sleep attacks. The ailment may indeed occur in very mild form so that some people would be relatively untouched by its symptoms.

A totally new understanding of

narcolepsy has been generated by the collaborative studies of Drs. Allan Rechtschaffen, William C. Dement and George Gulevish, one which should erase the medieval aura of fear about the syndrome. Following a hunch that the symptoms were related to the REM stage of sleep, a series of EEG studies were undertaken.

One early study showed that a narcoleptic can hold a conversation, discriminate between sounds, show other signs of being wide awake, and yet have the brain wave patterns of someone deeply asleep. A narcoleptic, wide awake, has skin conductance like that of the normal person asleep.

Nobody knows how narcolepsy is caused, although statistics about the syndrome in family groups suggests a genetic propensity. Current studies have demonstrated that the narcoleptic's bizarre symptoms are merely the symptoms of normal sleep, but very ill-timed. It is not that narcoleptics need more sleep than normal people, but the phenomena of sleep—of which most of

us remain unconscious—intrude into waking life.

Using chemical stimulation directly on the brain to elicit sleep and wakefulness, some investigators are presently attempting to decipher the chemical codes involved in nerve cell activity and determine their anatomical sites. Others have begun to detect chemicals generated within the body or the brain that influence sleep and allied behaviors; the detection of these chemicals offers some hope that we will learn to synthesize and use them. Finally, in studies that have an immediate and practical outcome, some researchers are ferreting out the specific action of common drugs and the effects of diet.

Drugs affect sleep

Tentatively, a number of investigators have looked at REM sleep as one kind of index of the effects of drugs or alcohol, permitting at least the loose prediction that continued loss of REM time will have undesirable waking effects.

Alcohol at bedtime does indeed diminish the duration of REM periods during the first hours.

Dexedrine, like alcohol, diminishes the amount of REM sleep. Dexedrine caused restless sleep in volunteers. It could be counteracted by combining it with phenobarbital, but the amphetamine would continue to suppress dreaming time. Evidence suggests caution in the use of amphetamines and especially in self-medication. A similar cau-

tion should apply to the use of barbiturates. They have been shown to reduce REM sleep, and in moderate amounts invoke some intellectual impairment on a behavior test.

Barbiturates are only one class of drugs used in treating sleep disorders. In final analysis, a wide use of them—and all centrally active drugs—will depend upon discovering how and where they perform their action within the central nervous system.

The hallucinogenic properties of LSD-25 have suggested that it might increase nightly dreamtime. In an initial study, using cats as subjects, Dr. J. A. Hobson of NIH found no increase of REM time. Instead, the LSD had an arousing effect, so much so that it deterred the animals from sleeping. This was a discouraging result, but in small enough doses, LSD appears to have the dream enhancing property that was expected.

One of the more important contributions of sleep research in the long run may be that it can make extraordinary mental disciplines available to all men.

Dr. Joe Kamiya, at Langley Porter Institute in San Francisco, has used the electroencephalograph as a teaching instrument demonstrating that control of the alpha state can be learned with surprising rapidity.

The characteristic alpha rhythm of about 9-12 c.p.s. appears when a person relaxes with eyes closed. This isn't drowsiness. The rhythm



At times during the REM state, oxygen content of the blood drops drastically and breathing becomes incredibly shallow.

vanishes on the threshold of sleep and also when a person becomes tense, emotionally upset or gripped by a problem.

Dr. Kamiya's laboratory is attempting to see how long the alpha state can be held by volunteers with a few hours of practice. This study may explain one of the perplexing and oft-repeated facts of history—that monks and moguls have been said to meditate continuously for many hours a day and to do with little sleep.

Further EEG and polygraph studies may reveal whether the alpha state does indeed perform some of the functions of sleep and what its special physiological properties may be. By using the EEG in a feedback system for instruction, Dr. Kamiya has been able to train people to identify, control and sustain a state in a manner that apparently takes years to achieve by Zen training. The same procedure will be used in attempts to instruct people in the control of other EEG patterns that correlate with mental states.

If, indeed, the EEG picture corresponds with mental events, this

research adventure is opening up the possibility of internal education, avenues of instruction in mental control. People may indeed learn to discriminate between the stages of sleep and learn how to awaken during a particular phase, as some people do awaken at a regular time without aid from alarm clocks.

Until recently, there has been little interest in the process of awakening. Recent work suggests that an important factor in the ease of awakening is not the length of time a person has been asleep, but the stage of sleep from which he is called to wakefulness. The difficulty in arousing people from sleep during the early part of the night may reflect the fact that the deep slow-wave stage 4 occurs most frequently in that initial period.

Since people may be able to learn to discriminate between REM sleep and stage 2, perhaps the discrimination can be further refined. A person might then learn to awaken from a stage of light sleep, an optimum point on the cycle, for it seems very likely that awakening comes more easily from some

phases of sleep than from others.

Dreams have always been the most fascinating part of sleep research, and today it appears that the dreaming of the REM state is a physiological as well as a psychological process.

During early studies of the REM period in adults, Drs. Eugene Aserinsky and Nathaniel Kleitman observed that the heart rate and respiration rate seemed to increase in these intervals. The physiology of the dream state warranted a much closer examination, and it was Dr. Frederick Snyder and his associates at the National Institute of Mental Health who initiated the now extensive exploration, starting in the late 1950's.

A closer look at the heart rate, the blood pressure and the respiration of sleeping adults revealed no simple and striking increases during REM sleep, for the increased levels were relatively small.

If the cardiorespiratory functions did not show large and uniform increases during REM sleep, they showed another pattern that is perhaps more alarming to the clinician apprehensive about nighttime cardiac crises. During REM periods the systolic blood pressure, pulse and respiration fluctuated, sometimes wildly, an erratic pattern that sometimes sent blood pressure above any levels observed during the quiet waking intervals before sleep.

These occasionally dramatic and sudden excursions in the heart rate and blood pressure may offer a clue

to the nighttime heart attack and cardiac failure during sleep. Many people have supposed that violent dreams might be the cause of such attacks, and a number of investigators have observed that particularly intense dreams may be accompanied by more eye movements and greater changes in respiration. It is early to say whether the emotionality and violence of dreams are always matched by greater changes in these outward bodily indicators.

Some recent findings by Dr. Aserinsky may help to explain this picture. At the onset of each REM period, respiration is regular, but it becomes shallow breathing. When breathing becomes very shallow, there is less oxygen in the blood. At times, during REM periods, arterial oxygen saturation drops below the point that a person would tolerate were he awake and holding his breath. This may trigger an acceleration, an increase in the respiratory rate. It is not clear exactly what causes this incredibly shallow breathing.

Bizarre events

As people look more closely at the physical dreamer, it is evident that the bizarre images, the travelogues of the mind, are not the only strange events of the REM period, but that the entire person must be swept by unusual excitations.

Perhaps the REM cycle in adults is an atavistic remnant, a brain activity whose main role was to gear the individual for survival by

inciting the development of drive-oriented behavior. Even if we discover that it does not have a role in the biological survival of adults, it may promote survival in the human being in a psychological-behavioral fashion that would not be as necessary in subhuman species.

Dramatic, recurrent, universal to mankind, the dream is nevertheless an experience that people cannot share. The dream that is communicated is a memory from a sleeping state. There have been a number of attempts to ascertain the memory span for dreams.

A psychiatrist, whose patients were awakened in one sleep laboratory, compared the immediate narratives with the patients' daytime recollections, and found that the morning versions were different.

Ten years ago it was possible for a person who remembered dreaming every night to look with pity on the impoverished soul whose nights were devoid of imagination—the person who said, "I never dream." Now it seems clear that we all dream about the same amount, every night. Why do some people not remember? There have been many speculations on this point. Patients in analysis, motivated by questioning, begin to remember dreams. Personality differences have been discovered in which introspective people have seemed to recall dreaming most easily.

A wealth of data suggest that there might be distinct physiological differences; some people dreaming at a lighter than normal level of

sleep and thinking themselves awake, while others dream in a deeper than normal stage of sleep and lose their dreams in the long process of awakening. But there seems to be another kind of forgetting as well, possibly repression.

By amassing a truly enormous number of dream reports and applying statistical analyses, the Dream Research Institute of Miami, Fla., has been finding out the general kinds of dream content that typify certain groups of people: normal college youngsters, the physically ill, the aged and people of particular ethnic groups.

The institute, founded and directed by Dr. Calvin Hall, is probably the largest repository of dream narratives in the world, its files containing some 30,000 dreams. Among these are 5,000 dreams collected from other countries and cultures, from Australians, Peruvians, Nigerians, Mexicans and many others. Many of these dreams have been broken down into components, classified and subjected to statistical procedures.

Dr. Hall and his associates have first classified items that occur most frequently: the kinds of characters that appear in dreams and their relationship to the dreamer, the setting, the objects, the dreamer's emotions, lucky or unfortunate events. Out of these analyses, they have developed manuals that might be used by a therapist, for instance, in analyzing a patient's dreams and judging whether these included more than a normal number of

*Analysis of thousands of dreams
shows that most are fearful, often
containing a sequence in which
the dreamer is pursued.*



fearful events. Although this large scale study is still in progress, the manuals offer some guides for judgment by citing the distribution of the categories of dream events for specific populations. For instance, an analysis of 1,182 dreams reported by young men and women suggested that about 2 out of 5 dreams are fearful, often containing a sequence in which the dreamer is pursued. A similar assay implied that for every dream of good fortune, a person may have seven dreams of misfortune. The dreamer is more often the victim than beneficiary. Questionnaires filled out by students who contributed dreams indicated that they felt only about a quarter of their dreams were pleasant.

An analysis of 7,000 dreams shows up one notable difference between men and women. Men tend to dream about men, in general, but women dream equally of men and women.

A recent study of the dreams of 60 nurses suggests that women's physiological cycles may influence their dreams. A tentative assay of dreams before and during menstruation shows that women may dream of waiting for something, ■ bus or

a train, during the premenstrual period, whereas dreams of destruction seem to occur during the first days of the cycle.

The task of interpreting dreams has grown no smaller now that we can clock them, collect more of them, try to manipulate them. Today's accumulation of data has instigated ■ few very tentative speculations, for dreams, their images, sensations, emotions, are physically part of us.

Less than 10 years ago, as scientists began moving across the borders of what we used to call unconsciousness, they began demonstrating that sleep was not an unconscious suspension from life, devoid of complex behavior and only tangentially related to the quality of our days. Instead, they confronted a very active brain which, in one stage of sleep, resembled waking to an amazing degree.

Hardly foreseen 10 years ago, the study of sleep has extended its benefits into medicine, pharmacology, psychiatry, into the scheduling of work and rest, and into the education of the individual acquainting him with himself and the uses of his remarkable brain, and the study is only beginning.



At left (from top to bottom) are normal specimens of Peppered Moth, Tulip Tree Moth and Oak Beauty. Mutated black forms (right) of the same moths now prevalent in cities.

Evolution by pollution

AIR pollutants that settle like a blanket of poison over cities and industrial areas have compelled man, the perpetrator, to defend his health and property by man-made means.

The moth, too, has been a victim of air pollution. But the insect's protective measure has been a

dramatic change in genetic structure.

Pollutants have not directly assaulted the moth; instead, they have destroyed the lichens—tiny, scaly plants—that grow on tree trunks. Lichens give trees a pale gray or green appearance, a background well suited to act as camouflage for a pale green moth.

Where the lichens have been destroyed, tree trunks have turned dark, sometimes nearly black, and enemies of the pale moth can spot it easily against the dark tree.

However, in the last 25 years, some 50 species of moths have developed for survival a dark mutated form which blends with the blackened tree trunks.

Such genetic readjustment is being studied by Arthur M. Shapiro of the Academy of Natural Sciences of Philadelphia who did his graduate work in insect ecology at Cornell University.

He discovered that it was in highly industrialized Pittsburgh, as far back as 1898, that the first black moth specimen was found. In 1908, a melanic dark form of the speckled Tulip Tree Beauty moth was found in Roxborough, Pa., a section of Philadelphia near the Schuylkill River.

Now 60 percent of these moths are of a dark variety on the Pennsylvania side of the Delaware River and, because of westerly winds that waft Philadelphia pollutants in that direction, nearly 75 percent are melanic on the New Jersey side.

Before the advent of industry and air pollution, black mutations occasionally and conspicuously did appear, only to be eaten by hungry birds before they could mate and pass along the mutation.

Now that the light moths are being seen and picked off the dark tree trunks, the soot-colored forms are multiplying.

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Can we change the weather?

A high-powered science committee says we can. But do the experimental results so far justify the optimistic predictions? Many scientists say they do not.

by Bruce Frisch

So many people have wanted so badly for weather modification to work that for 18 years they have been trumpeting announcements that it did. In fact, they might as well have been sprinkling Rice Krispies into the clouds for all the proof they had that cloud seeding produced rain.

Now, an all-star panel on weather and climate modification of the National Academy of Sciences has concluded after two years of the most exhaustive study to date that seeding does work.

This is almost the only bright spot in the whole two-volume report. "The report is a curious document," says the British journal, *New Scientist*. How, it wonders, can page upon page of gloom be followed by a cheery forecast, a call for one government agency to be given the leader's job in the field and a plea for a boost in annual Federal weather modification spending over the next five years from \$5 million to \$30 million?

"During approximately the past

decade, subtle but significant shifts have occurred in long-term prospects for weather and climate modification," the panel argues. The shift is so subtle that it almost escapes the reader. The raise in spending depends almost entirely on the panel's decision that cloud seeding does increase precipitation on the order of 10 percent. Because seeding is the big maneuver in almost every kind of weather modification, from hurricane slaying to fog dissipation, its proven effectiveness opens up a whole new range of possibilities, previously only fanciful.

Seeding is like a judo punch. The energy tied up in the weather so outweighs any possible frontal attack by man—for instance, the power of a single, local summer thunderstorm equals one-third that of the whole U.S. electric generating industry—that scientists had to search for a vulnerable spot where a little effort would get a lot of results. The spot was located in 1933 by Tor Bergeron, a Swedish physicist, but not until 1946 did Vincent Schaefer and Irving Langmuir of

General Electric find ■ way to hit it, and not until today have we been able to make the judo punch work.

Bergeron explained how a raindrop is born. Warm, moist air rises and cools. At the lower temperature, the air can't hold as much water vapor. As the dew point is reached, droplets condense on dust particles. A cloud forms but does not yet contain raindrops.

The heat released by condensation buoys the air higher, where it cools further. As the temperature drops below the freezing point, droplets begin solidifying around a different set of dust particles. Su-

percooled droplets near the ice crystals then evaporate and recondense on the surfaces of the crystals. Soon the ice crystals are large enough to fall to lower, warmer altitudes where they melt into raindrops.

Natural nuclei for water droplets and ice crystals are volcanic dust, sea-salt particles, dust from wind erosion, pollen, spores and smoke from forest and brush fires. There are always plenty for droplets to form around. Those suitable for ice nuclei are 1,000 times more scarce. As a result, for the lack of a nucleus, ■ droplet may stay liquid all the way down to -40°F , where it

Seeding explodes a cloud

Seeding with silver iodide can affect the formation of a cloud, as this experiment shows.



1 Cumulus cloud following the seeding.



2 Nine minutes later, expansion begins.



3 In 19 minutes, cloud shape has changed.



4 Within 38 minutes, cloud has "exploded."

will freeze without a nucleus. Schaefer and Langmuir thought of supplying the missing nuclei with dry ice or silver iodide crystals.

Thus began rainmaking. Many scientific projects on the West Coast have since been aimed at squeezing more precipitation out of Pacific air that moves up the slopes of western mountains in the winter and drops snow that waters irrigated farms and drives hydroelectric plants the rest of the year. Results from 1957 that indicated 10 to 15 percent gains in rainmaking have since been challenged and await confirmation by recent trials.

Normally, these clouds drop only 20 to 30 percent of their moisture. Cumulus clouds, those puffy white cotton balls, are an even more tempting target, since they rain out only 10 percent. The panel will say only that the U. of Chicago's Project Whitetop in southern Missouri showed "modest precipitation increases."

Cyclones rerouted

At first glance, cyclones might seem the most logical targets. These 600-mile-diameter storms follow one after the other along a track dipping into the Midwest from Canada and exiting to the North Atlantic over the Northeast. They supply much or most of the precipitation in the areas they cross. However, there is a "suspicion" that they lose nearly 100 percent of their moisture anyway, so that all that could be done would be to

change the distribution.

The way the simple idea behind rainmaking has been bent to cover almost every other weather desire is amazing. Take hail. A summer cumulus cloud sprouts into a tall thunderhead. Ice crystals grow and start to fall but get caught in the powerful updrafts and carried up through the supercooled layers again and again, growing a new coat of ice each time.

Hail seeding risky

If the jet stream is overhead, it may carry away the top of the cloud as fast as it forms. Instead of the thunderstorm's continuing through its brief life cycle, it will turn into a continuous hail machine leaving a hail "road" stretching 100 miles or more.

Hail fighters operate on the theory that by seeding they will make hailstones more numerous, therefore smaller and less damaging. The French have been trying this for 15 years. In 1959, the men who run the project said that insurance claims for hail damage in the area covered had been below average every year but one. An outside analyst, however, found an almost continuous increase of damage in the target area in comparison to neighboring regions.

Likewise, a five-year Argentine project cut hail damage from one kind of storm by 70 percent but doubled the damage from a different type.

"The greatest enthusiasm eman-

"If we understand the hurricane, we may be able to control this giant."

ates from Russia," the panel reports. There radar targets are tracked as they are swept up through the cloud. Then artillery shells loaded with silver iodide are fired into the section where updrafts are strongest. Although the shelling is not run in a way that can be checked scientifically, the Russians feel they are "highly successful".

For the United States, hurricanes are a bigger worry. They are born in the tropical Atlantic and the Caribbean where they draw their energy from the hot surface water. Soon the high winds chop the tops off large waves, making it impossible to tell where water and air meet. This mixing speeds the feeding of heat to the hurricane. Little is known about the storms' early life in their remote spawning grounds.

"By the time a storm is off the coast, within the range of our reconnaissance aircraft, it is already a roaring monster," the panel noted. Even then, the middle levels, which are the most accessible, are the least important. What we need, says the panel, are a synchronous satellite overhead to give us a movie of the full life of a hurricane, and a submarine to take the surface and depth temperature of the water.

One theory of hurricane control was tried out on two storms in Project Stormfury. By seeding the eyewall cloud, it was thought, the

balance of forces and smooth functioning of the storm could be upset and windspeeds reduced. Esther in 1961 and Beulah in 1963 both responded with 10 percent drops in windspeed, but these could have been normal fluctuations. The panel is still hopeful. "We may be able to control this giant some day," it says, "but only if we understand her first."

The state of our knowledge of the tornado is worse, "primitive" says the panel. Twisters drop out of the sky, particularly over the Great Plains in April, May and June, when cold dry air from the north noses under hot, moist air from the Gulf of Mexico. Texas, Oklahoma, Kansas and Missouri make up "tornado alley." A typical funnel churns out power equivalent to the explosions of 20 tons of TNT per second. One faint hope for control rests on Dr. Bernard Vonnegut's theory that lightning discharges play a part in starting a funnel.

Lightning prevention

We are doing nothing about tornadoes, but we are doing something about preventing lightning.

Each year in the western states about 10,000 lightning fires break out. This has prompted the U.S. Forest Service to undertake Project Skyfire in which clouds are seeded to increase the number of ice crys-

tals. The crystals are meant to act as lightning rods, leaking away electric charges so they can't build up into a lightning stroke. A two-year trial in Montana may have reduced the number of lightning strokes from clouds to the ground by 38 percent. On the other hand, there may have been fewer but more intense strokes more likely to start fires. There is also the possibility, according to one theory of charge formation, that seeding increases the lightning.

Besides possibly triggering tornadoes, electrification may affect precipitation. Gushes of rain have often been noticed after lightning strokes. Checks in the lab revealed that an electrical field increases the mating of droplets in a spray. In actual use, however, electrification has yet to work out.

Ions charge raindrops

One experimenter towed a high voltage a.c. wire behind an airplane and flew through a cloud. He figured that the alternating voltage would leave a trail of positive ions for several feet, followed by a length of negative ions. The ions would light on and charge raindrops which would be drawn together into larger ones more likely to fall. Other experimenters have strung up wire on the ground in the hope that the ions would be wafted up into the clouds. Grasping at anything that might help fill its dried up reservoirs, New York City sent a team out to California to

observe such an experiment last summer. One of the team came back with a sunburn. Naturally, not even ions could wring rain out of cloudless California skies. But even under the best conditions no ion experiment has worked outside the lab.

Fog scavenged

A charged wire has been tried on warm fog, too, in the hope that it would make the mist coalesce and fall to the ground. The more direct approach of spraying water into the fog has worked for the Japanese when the mist was thin.

The Japanese have also explored planting trees to scavenge fog along coasts where cold currents make fog a regular occurrence. With modern materials, Chileans have built artificial scavengers to strip water for irrigation from fogs that fill the mountain passes. Droplets form on nylon threads strung on wooden frames and run off into pipes. In its turn, the New Jersey State Highway Department has picked up the idea and will mount several whirling frames on a flatbed truck in an attempt to sweep a clear path down a fog-shrouded road. Yet, many years later, the only method that really works is the one used at British airfields in World War II, costly arrays of massed oilburners to dry out the fog.

Basically, the difficulty with warm fog is that it has no soft-spot instability.

Cold fog is a different creature. It

We may already be changing the climate inadvertently with pollutants.

is just like the supercooled parts of a cloud that are most vulnerable to seeding, and therefore easy for commercial airlines in winter and the Air Force with its Cloudbuster system to clear fog from runways with dry ice.

Success stories like this appear rarely in the report. The panel maintains a severely critical attitude, perhaps in reaction to years of premature claims. But it reserves its scorn for climate modification. Schemes like the ones to dam Bering Strait and pump the cold water out of the Arctic Ocean or spread coal dust over Greenland to melt the ice cap it dismisses as "grandiosities."

More promising than these supercolossal daydreams, if vaguely so, is manipulation of the possible wave-like actions of the weather noted in a companion study by the National Science Foundation. The wavelike character of warm and cold fronts suggests that repeated interventions on a manageable scale in resonance with the atmosphere could build up a worthwhile effect.

To the National Academy of Sciences panel, success by seeding is a threat as well as a promise. It dreads our acting in any field of weather modification before we are sure what the results will be. If ordinary hurricanes are prevented, will the energy bottled up in the tropical seas pile up into super

hurricanes? "Whatever our discontent with local characteristics of the present world climate, we should bear in mind that things could be much worse, as they have been in the distant past," cautions the panel.

We may already be changing the climate inadvertently with pollutants. The tens of thousands of tons of smoke that rise from some cities each day and have cut the sunlight reaching them as much as a third, can also act as cloud-seeding nuclei. Population growth, industrialization and urbanization will swiftly swell the danger. Much smaller weights of pollutants dumped by H-bomb tests and passing rockets can radically alter the makeup of the upper atmosphere.

The NSF committee is afraid just as much for plant and animal life. We know enough about only a few species to predict the effects upon them of weather modification. Studies of past climatic shifts show that a change of 3° F to 4° F will reshuffle the population sizes of the species in an area, but only a few will be driven out. After changes of 6° F to 8° F, the complete character of the territory will be transformed, say from evergreens to leafy trees. In the United States, many species have been driven to islands surrounded by human-occupied barriers across which they can not migrate. For these species, large weather shifts would mean extinc-

tion. But not only large alterations would be damaging. "Living things are adapted to the weather that actually prevails, and any change will produce net harm," says the committee.

Math Predictions

Thus the panel is pushing for more research into the why's of weather. This will give a bigger downpour for a dollar, but it will also make weather modification more precise and predictable. Seeding is the tool; now we need a brain to guide it. That brain will be numerical prediction, which is nothing less than a mathematical model of the earth's atmosphere.

This is the way it works.

The present picture of the weather from a grid of stations covering

the globe or the hemisphere is plugged into equations describing how the atmosphere works. As the computer grinds through the equations, the mathematical atmosphere lives through an accelerated day, week or month into the future.

Ideally, a projected weather modification scheme could be tried out on the computer to see what the consequences would be. Also, new leverage points to be exploited could be uncovered in the weather's workings.

Today, three dark clouds mar this fair prospect. Most of the stations on the grid are imaginary; equations are inexact; computers are 100 to 1,000 times too slow.

These clouds the panel would dissipate with dollars, the kind of seeding, it is hoped, that will rain on us all.



"Harry's got some kind of hare-brained scheme about orbiting the garbage every night."

QUIZ



KFS

Killer wind

by John and Molly Daugherty

THE nation's severe-storms center—SELS—in Kansas City, Missouri, is in the middle of Tornado Alley. It instantly alerts airports, TV and radio, and the Red Cross of coming tornadoes. SELS scientists are creating small tornadoes (with tobacco smoke and wires for heat) in their labs to study the mechanics of tornadoes that are not fully understood.

Aside from taking cover in the corner of your basement nearest the approaching twister after you open the far doors and windows, what do you know about tornadoes?

1. A few lucky people hit by a tornado have survived unharmed. It picks them up, carries them a distance, and then gently sets them down in a cornfield, perhaps. This miracle can be accounted for by
 - a. Pressure exerted by the wind
 - b. Updraft
 - c. A vacuum

2. The average tornado lasts about
 - a. 12 minutes
 - b. 4 minutes
 - c. 21 seconds
3. Statistics over a long period are meaningful. From 1916 to 1960, a 45-year period, the state that reported the largest number of tornadoes was
 - a. Arkansas
 - b. Nebraska
 - c. Kansas
4. During the same time, the state citing the largest number of days on which tornadoes occurred was
 - a. Texas
 - b. Florida
 - c. Kansas
5. The fewest tornadoes reported by the U.S. Weather Bureau during the same 45-year period were in
 - a. Alabama, Georgia and South Carolina
 - b. Nevada, Rhode Island and Alaska
 - c. Maine, New Hampshire and New York
6. The most violent of all windstorms is a
 - a. Tornado
 - b. Hurricane
 - c. Typhoon
7. The average speed at which a tornado travels is around
 - a. 30 m.p.h.

- b. 80 m.p.h.
- c. 100 m.p.h.

8. The suction power of the partial vacuum within the whirling funnel of a tornado is tremendous. The air pressure within the funnel is

- a. Least at the tip of the funnel (near ground contact)
- b. Least near the cloud above (wide part of the funnel)
- c. About the same throughout the funnel

9. The narrow funnel-shaped cloud that is a twister rotates at an estimated speed of

- a. 90 m.p.h.
- b. 900 m.p.h.
- c. Several hundred m.p.h.

10. Tornadoes occur in

- a. All continents
- b. Only the United States
- c. Only the United States and Australia

Answers:

1—b Updraft. In the funnel of a tornado, updraft winds exist with tremendous force. Wind speeds are as great as 200 m.p.h. or more. If a person lifted a great height were to fall through *still* air, he would be severely injured or killed. But the updraft allows him to descend to the earth slowly and gently as though by parachute.

A tornado which tore a house apart picked up a cabinet of dishes in the kitchen, carried the cabinet some distance, and then set it down without breaking a single dish!

2—b Four minutes. The duration of tornadoes varies from a few seconds to four hours. The width of the funnel is as narrow as 9 feet and as wide as two miles, but the average is 1,000 feet. Tornadoes cut a path from several feet long to 300 or 400 miles.

3—c Kansas. Kansas reported 1,167 tornadoes. Texas was second with 1,159, but when you compare the sizes of the states (Texas, 261,339 square miles and Kansas, 82,256 square miles), Kansas has a much greater density of tornadoes per square mile. Oklahoma was third, with 1,025 tornadoes.

4—a Texas. There were 645 tornado days in Texas, 606 in Kansas and 254 in Florida.

5—b Nevada, Rhode Island and Alaska. Each reported one. The figures for the other states are: Alabama, 338; Georgia, 295; and South Carolina, 161. Maine, 30; New Hampshire, 18; and New York, 38.

6—a Tornado. The tornado's behavior often is so fantastic that reliable reports of the devastation seem incredible. Hurricanes, however, cover a much larger area and last longer than tornadoes. As a result, the total destruction in a hurricane, which may last as long as three weeks and cover one-half million square miles, is greater than that of a tornado.

In the United States, winds over 73 m.p.h. are called hurricane winds. Some have been clocked at 150 to 186 m.p.h. for short periods of time —five minutes or less.

7—a Thirty m.p.h. Some tornadoes dally along at 5 m.p.h., and others rip across the countryside at 65 m.p.h. Their roar is like that of a jet, but when you hear it, it's too late!

8—b Least near the cloud above. The suction causes objects to be drawn up the funnel and is associated

with the action of the updraft in the funnel. As the funnel passes over a house, the air pressure inside is greater than that outside, and the forces created by the differences in pressure cause the walls to blow out and the roof to be pushed up. If the normal pressure is reduced only several pounds a square inch, the force on a typical room wall could be thirteen tons outward and twenty-six tons on the ceiling upward. From the explosive force of some tornadoes, the reduction of air pressure may well be 50 percent to produce some of the amazing results of the vacuum that have been recorded.

9—c Several hundred miles per hour. Speed can get up to 500 m.p.h. There's often a bluish glow near the bottom of the funnel, though the clouds are dark, usually grey, because of the condensation of the water vapor. Sometimes, however, they don't merge into the funnel. Intense electrical activity precedes and accompanies the tornado funnel, the axis of which can be contorted or vertical. It gyrates and bounces up and down, changing shape, and it is often described as looking like an elephant's trunk.

10—a All continents, but the most violent ones occur in the United States. The United States and Australia are the most frequently ravaged by them.

Score yourself:

9—10 right—You're a whirlwind.
4—8 right—You know enough to lie down in a ditch when you see one coming.
0—3 right—This quiz was a real twister for you!

How Fast Can You Read?

A noted publisher in Chicago reports there is a simple technique of rapid reading which should enable you to double your reading speed and yet retain much more. Most people do not realize how much they could increase their pleasure, success and income by reading faster and more accurately.

According to this publisher, anyone, regardless of his present reading skill, can use this simple technique to improve his reading ability to a remarkable degree. Whether reading stories, books, technical matter, it becomes possible to read sentences at a glance and entire pages in seconds with this method.

To acquaint the readers of this publication with the easy-to-follow rules for developing rapid reading skill, the company has printed full details of its interesting self-training method in a new booklet, "How to Read Faster and Retain More" mailed free to anyone who requests it. No obligation. Send your name, address and zip code to: Reading, 835 Diversey Parkway, Dept. C786, Chicago, Ill. 60614. A postcard will do.



A stray Fairy Penguin wanders over to an enthralled viewer.

Nature's most delightful parade

DRESS suits are a must in a parade that takes place nightly on Phillip Island, 85 miles from from Melbourne, Australia.

Every evening at sundown from September to March, arc lights illuminate the sand and, to the 4/4 time of martial music, formally attired little creatures emerge from the sea and march with well-rehearsed precision to the burrows that are their homes.

No, it's not a bunch of demented chorus boys in moldy monkey suits. These are the dignified, if dumpy, figures of penguins.

Nearly 2,000 birds comprise the resident company of the Parade of the Fairy Penguins, a show of nature that nightly draws an audience of 500 to 3,000 people. Few are around to witness the sunrise

performance, when the birds march down the beach to the water.

During the day, penguins swim up to 30 miles out to sea to catch fish for their young, who are on shore waiting for their parents to bring home supper.

Though the penguin's waddle is not the ideal marching step, the rotund birds have been a major tourist attraction since 1945. Before that, they went through their paces unmolested, delighting the local residents, stray visitors and naturalists who came to study the habits of the birds.

As news of the passing parade spread, the number of viewers increased; spontaneous and sometimes violent audience participation began to decimate the ranks of the penguins.



Australian News and Information Bureau photos

One of the many bands of penguins marches across the sand during nightly performance.

Finally, the Victorian State Department of Fisheries and Wildlife joined forces with the local people to light the beach and rope it off each night, separating the birds' passageway from the spectators.

The performance itself has the ritual grandeur of a Japanese puppet show with slapstick overtones.

A shadowy blob lurches onto the beach from the waves. The lead penguin—for it is a penguin—is soon joined by another bird, and another, until 20 to 40 birds are in the group. Then, at some secret signal, the first band of birds begins to strut up the beach, followed at a

prescribed distance by other groups.

Full of fish that they've spent the day catching for their young, the extra $\frac{3}{4}$ of a pound each penguin carries doesn't make it any easier for him to walk, let alone march. Occasionally, one tumbles over, a sign for his comrades to halt in a body and squawk disapprovingly until he rights himself and rejoins his group. Again, at a silent command, the groups break formation, retire to their respective burrows and regurgitate the fish so the baby penguins can eat.

The penguin parade is over until the next night's performance.

Right: Fairy Penguin and child snuggle together in one of the grassy burrows 18" to 3' long—where the young are hatched. Smaller than the King Penguin of Antarctica the Fairy Penguin (*Eudyptula minor*) is found only in the southern hemisphere.



THE HUGH DOWNS COLUMN



Prenatal weightlessness at the Beverly Hilton

IN 1955, I had an underwater experience so highly subjective that I would never have expected to write of it except for a recent feature article relating strongly to what happened to me. The item was a feature story in a national magazine, an account of a woman who calls herself a hydropsychotherapist. Mrs. Lily Wiener of Los Angeles floats patients in warm water in a foetal position to induce meditation that may unlock very early recollections and feelings.

My experience, a decade earlier than Mrs. Wiener's experimenting, came about by accident. The hotel pool at the Beverly Hilton Hotel in Los Angeles had been heated to 96° F—near body temperature—for a television demonstration of how 'water babies', as they were called, had no fear of water. Infants six weeks and up to several months old were dunked with no panic—they were not specially trained to be fearless, but, according to the theory, were naturally at home in

warm fluid, very much like the environment where they had spent the first nine months of their existence.

The thesis is, "You've got to be taught." Little children become afraid of the water after seeing the fear their mother shows when they go near it. To demonstrate the fearlessness of the very young, the water should be quite warm.

The day after the water-baby demonstration, since pool temperatures don't change quickly unless the water is changed, the pool was still warm. I was testing some diving equipment of a West Coast manufacturer. A few of the hotel guests came to the pool but found it too warm to stay in. One of these guests lost a contact lens while she was in. I offered to look for it. I think it would literally have been easier to find a needle in a haystack, because the index of refraction of a contact lens is so near that of water that it just about disappears. But I tried it anyway. I felt around the bottom of the pool over a wide area where she thought it might be. But it most likely had gone into the drain. I finally gave it up.

I had a good half hour of air in my tank and a comfortable amount of belt weight so that I ballasted out just slightly on the heavy side. I found that if I relaxed completely in any attitude, I would slowly turn to a face-down position bent forward at the waist with my knees drawn up slightly and my toes just touching the bottom. Inhaling and exhaling, in changing my buoyancy,

caused a slight rhythmic rising and falling.

There is no way to describe the hypnotic effect of this combination of silence, slight motion, weightlessness and warmth. It is indeed a duplication of the prenatal condition. Except for respiration and complexity of mental activity, it is very nearly identical.

Mood dreaming

I went to sleep. For ten or fifteen minutes, I was in a strange sleep that brought the kind of dreaming I call "mood" dreaming: no recognizable plots, and more characterized by emotional flavor than by bizarre events. Strong, raw feelings of triumph, doom, frustration and joy highly colored and often unique make up these dreams, which are said by experts to accompany the deeper levels of sleep.

What did I dream? What would I have reported to a psychiatrist if one had been there? Or to a hydropsychotherapist? My memory of the experience has faded a little and even when it was fresh it couldn't have been put into words with any real accuracy.

It was as though I was at the edge of a rock cliff—beside it, not on top near the edge, but floating near the sheer side, beyond which was the infinite black void of the night sky. Distant stars shone from all over out and above. Below, there was no ground but only more night sky studded with the unwinking faraway stars. I might have been

hovering near an asteroid in space.

The opposing concepts of massive stone and deep void were somehow magnified in my feelings to an intensity that made awe a conscious characteristic of my awareness of the cliff edge and the empty space. Both notions inspired in me a terror of such magnitude and flavor that I remember them chiefly because feelings of the sort I'm about to try to describe are not normally given to me either in ordinary dreaming or when confronted with crises.

Doom-flavored humility

The evolution of this unique (for me) mood went from a startling sense of vastness and solidity to an intensification of these qualities; in these stages the mood conveyed definite weightlessness and something like vertigo, since the black sky was beneath as well as above. The sense of being lost pervaded the experience, along with mild distress at the disorientation, not only of direction but of location as well. The forbidding lifelessness and impenetrability of the rock had a taint of morbidity as in early feelings about the massiveness of gravestones. The void seemed unnecessarily immense.

Humility of a frightening kind bore down on me—too big, too empty, too lifeless, too heavy, too hard, too unyielding, too cold, too unanswering and over-all too unutterably lonely. From this point, the doom-flavor of the mood deepened to such overwhelming proportions

that despair replaced any initial reaction to combat or alter the circumstance and the despair became more than majestic: It invited surrender and promised something infinitely sweeter than victory—but the price was total. Nothing short of abandoning one's identity, one's total self would allow exploration of the next level.

Ideas of death were surely incorporated in this inexpressible concept although I can't say that my memory of this dream holds any conscious idea of dying at the time. It was more a temptation to give up and a promise that if I abandoned my identity, I would also abandon the morbidity associated with the massive stone and the deep emptiness of the star-strewn space; and that in their places, by volunteering to make myself vulnerable to whatever threat they seemed to pose, I would find a reality that would clearly show the forbidding characteristics of infinite emptiness and locationlessness and directionlessness to be purely products of my own imagining. The mood deepened to one more level and then disappeared.

Last stage—affection

In that final stage, I felt my respect and awe of these scary things change into what I can only describe as a sort of affection for them. It seemed more reasonable to go further in that direction than to come back.

Right at the last, I sensed an

"There was a great temptation to totally abandon my identity."

intrusion—unwelcome and in no way (it seemed at first) related to me or anything I was doing. The intrusion was a sound of breathing, which I had been doing right along I must assume, but that now from a distance echoed between the walls of my air tank and through the hoses of my scuba gear. At first, it had nothing whatever to do with me and belonged to another world that was unwelcome in the new world I felt I'd found. Finally, I knew without opening my eyes that it was my own breathing I was hearing. I heard it well before I reconnected it with any physical feeling of breathing.

If we were to apply symbolism of birth here, the experience of coming out of the warm fluid and then breathing was reversed. I was breathing but still floating undisturbed in the amniotic fluid. All of this, bear in mind, is pieced together from a memory not possibly so definite as I have put it down, but related so as best to convey the general mood of the experience.

I became conscious of where I was, but it was a long time before I moved or felt I knew how to move. After several seconds I opened my eyes and then moved my legs slightly. That broke the spell. I then became conscious that my throat was terribly dry. There is never enough humidity in an air tank for some reason. But when

awake, one can take in a little water to moisten the throat—not unpleasant in fresh-water diving, and not intolerably gagging in the sea. I drank a little of the pool, moved a little more and finally climbed out of the pool and sat for a long time on the edge, in some wonder at how I had gone to sleep and how strange and different the sleep was.

Psychedelic parallel

I have since read descriptions of vaguely parallel experiences by people taking psychedelic drugs.

This kind of thing, tinged with mysticism, is no longer outside the proper concern of science. It raises many questions, one of which is: What effect does weightlessness have on the unborn infant? Suspended in a fluid, one's weight is translated to pressure. Once born, a human being is given a sense of direction—an 'up' and 'down' and he will have it for the rest of his life, except when he is submerged or falling or in orbit.

But all prenatal existence must lack the spatial orientation a human retains even during sleep (however soft the bed), when pressure on one side of his body tells him constantly which way is 'up.' Whatever dreams the unborn infant has, he is not plagued with problems of falling, or up, or down or the absence of these ideas. Space

extension must be a concept built up after birth unless some inkling is programmed into reproductive cells.

Small wonder the newly born have a fear of falling. They are plunged into a world of one gravity which is brand new—as brand new as breathing. Imagine yourself in the state I tried to describe when I went to sleep in the pool, thoroughly in tune with the void, in tune with a universe of no direction or location, and no differentiation of your identity—in other words, no subject-object relationship separating you from the universe—at peace with the deepest thoughts.

Then imagine your folded, mucus-filled lungs assailed suddenly by fiery oxygen and cold nitrogen and a constant acceleration of 32 feet-per-second-squared from one direction against your body.

You've been through this once already, when you were born. And you cried. I doubt that you remember it. But if you ever go to sleep under water you may, for whatever it's worth, bring back a little of the earliest memories you ever had. And if it's of value to get at those earliest feelings, the field of hypnotherapy may have a bright future.

You can't change a cat's paw

NOTHING will stop your cat from leading with his left, paw that is; even extended training can't make a cat change his paw.

Cats have decided paw preferences. That's what Dr. J. Michael Warren, director of the Animal Behavior Laboratory at Penn State, discovered with 34 cats he tested over an extended period of time.

Preference for the right hand or left hand is dictated in humans by a specialized part of the brain, a physiological development for which Dr. Warren was eager to test felines.

Each cat was placed in a "behavior" cage while, outside the cage, meat or other goodies were placed inconveniently at the end of a test tube, at the bottom of a shallow trough or hidden under a wooden block, forcing the cat to retrieve the bait with one paw.

Nine tabbies used the right paw while eight preferred the left paw. One cat, a sleek black and white male named Moses, was ambidexterous.

To see if he could reverse their preference, Dr. Warren tied a glove on each cat's preferred paw. The bulky cover kept the cat from reaching through the cage bars and compelled it to grasp the meat with the non-preferred paw. But after 1,400 trials, the cats reverted to the favored limb.

Dr. Warren concluded from his experiments that a cat's paw preference is very similar to man's hand preference—it's strong, stable for a long period and resistant to training—a finding that will be useful in studying how man's brain evolved.

PLEASE EXPLAIN

What is time?

In "Project Time Out," conducted by the Bulova Watch Co., residents of N. Conway, N.H., like Mrs. Peter Pinkham did without modern timepieces for two days to test the need for time measurement.



Is time an illusion or does it really exist? How would you describe it?

Time, to begin with, is a psychological matter; it is a sense of duration. You eat and then, after a while, you are hungry again. It is day, then, after a while, it is night.

What this sense of duration is, what it is that makes you aware of something happening "after a while," that is part of the problem of the mechanism of the mind generally—a problem yet to be solved.

Each individual comes to realize that his sensation of duration varies with circumstances. A day at work seems much longer than a day with your sweetheart; an hour at a dull lecture seems longer than an hour at cards. This might mean that we call a "day" or an "hour" is longer some times than others, but there is a catch. A period of duration that seems short to one may seem long to another, and neither unusually long nor short to a third.

If the sense of duration is to be useful to a group of people, some method of measuring its length

must be found that is universal and not personal. If a group agrees to meet "in exactly six weeks," it would be useless to have each individual appear at the meeting place when he feels somewhere inside himself that six weeks has passed. Instead, all must agree to count forty-two periods of light-darkness and then show up regardless of what his sense of duration tells him.

When we choose some objective physical phenomenon as a means of substituting counting for our innate sense of duration, we have something we can refer to as "time." In that sense, we mustn't try to define time as something, but merely as a system of measurement.

The first measurements of time involved periodic astronomic phenomena: the repetition of noon (sun at maximum height) marked off the day; the repetition of the new moon marked off the month; the repetition of vernal equinox (the sun over the equator after the cold season) marked off the year. By dividing the day into equal smaller units we get hours, minutes and seconds.

These small units of time could not be measured accurately, however, until use was made of a periodic motion more rapid than the repetition of noon. The use of the even swinging of a pendulum and of the even oscillation of a hairspring, made modern timepieces possible in the seventeenth century. Only then did the measurement of time become reasonably precise. Nowadays, we use the vibrations of atoms and the oscillations of light waves for even greater precision.

How can we be sure that these periodic phenomena are really "even"? Are they as unreliable as our sense of duration?

Maybe so, but there are several independent ways of measuring time and we can compare them with one another. If any of them are markedly uneven, it will show up in comparison to the others. If *all* the ways are uneven, then it is enormously unlikely that they will all be uneven in exactly the same fashion. If, then, the methods of measuring time match very closely, as *they do*, we can only conclude that the various periodic phenomena we use are all essentially even! (Not perfectly even, though. The day-length varies very slightly, for instance.)

Physical measurements measure "physical time." Various organisms, including man, have methods of

involving themselves in periodic phenomena (such as waking and sleeping) even without reference to outside changes (like day and night). Such "biological time" is not as remorselessly even as physical time, however. (See "Your Hidden Life Asleep, page 62.)

And, of course, there is the sense of duration or "psychological time." Even with a clock in plain view, it *still* seems that a day at work is longer than a day with your sweetheart.

—Isaac Asimov

What causes "sinus trouble" and what can be done about it?

There are four pairs of sinuses or "pockets" in the nasal area. No one knows exactly what they are good for. It has been suggested that these hollows serve to lighten the skull and make it easier for man to hold up his head. But certainly this is not the foremost reason for their being.

Thousands of people have found out that the eight sinuses can become infected and make them miserable. An infected sinus, called sinusitis, is difficult to distinguish from the common cold except when symptoms become severe enough to cause a headache or a stuffed-up feeling in the head. Frequently sinusitis is caused by a cold.

Before the introduction of antibiotics and sulfa drugs, treatment of acute sinus infection could be painful. Surgery was often resorted to. Today, in addition to prescrib-

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ing drugs, physicians recommend a well ventilated sleeping room with a humidity between 40 and 50 percent. Aspirin is recommended for pain. Sometimes heat is applied to the sinuses. Vasoconstrictor inhalers may be recommended to shrink the nasal passages to permit easier breathing through the nose. In unusually acute attacks, the physician may resort to irrigation to flush out the purulent matter. A. J. S.

What is an artesian well?

The word artesian comes from the ancient province of Artesium in France. Since the days of the Romans, water has flowed to the surface from wells in this area. The name is now applied to all wells which contain water under natural pressure. In ordinary wells, one digs a hole deep enough to reach the water-table or water saturated zone of the earth. Water then drains into the hole and can be hauled or pumped to the surface.

Artesian water exists in areas that have a particular geological setup. There must be an aquifer, a material like sandstone which is porous enough to collect and retain large quantities of underground water. The layer above the aquifer has to be a watertight, or nearly watertight material, probably clay or shale, that holds the water in the aquifer. Being confined, the water is under pressure. If a well is drilled into the aquifer, the water will rise in the well, and perhaps flow out at the surface.

Why Do You Have A Poor Memory?

A noted publisher in Chicago reports there is a simple technique for acquiring a powerful memory which can pay you real dividends in both business and social advancement and works like magic to give you added poise, necessary self-confidence and greater popularity.

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STAMPS For collectors: Breaking up fifty year personal collection. Choice U. S. and Foreign at realistic prices. Send for selection on approval. Russell Kay, Box 14382, Tampa, Florida. 33609.

50 DIFFERENT Stamps, 25¢, with beautiful approvals. Postage paid. Charles Cook, Box 4254, Chattanooga, Tennessee.

COINS, TOKENS, CURRENCY

IMMEDIATE Cash for your coins! Send them insured! Terrific prices paid! Fairway Co., Box 121-D, Rye, N.Y.

SILVER Dollar \$1.75. Flying Eagle Cent \$3. With terrific price list. Nelson Co., 346-D, Rye, N.Y.

FLAGS, EMBLEMS AND PATCHES

FLAG For Servicemen's families. Defense Dept. authorized. \$2. U.S. Publishing Co., Stuart, Fla.

EARTHWORMS, LIVE BAIT

HYBRID Red Worms, hand picked, 1,000—\$3.00: 5,000—\$8.00; 10,000—\$14.00; bedrun, 20,000—\$20.00. Postpaid with raising instructions. Brazos Bait Farms, Route 9, Waco, Texas.

F FARMS—REAL ESTATE

FARMS West central Minnesota, 80 to 800 A—corn & bean land. Free List. Thedin Realty, Morris, Minn.

BUSINESS OPPORTUNITIES

GROW Orchids at home. Booklet 25¢. S. Presner, Box 10, Coral Gables, Florida.

How To succeed in specialty manufacturing. Details free. Jackson, 529 Elm, Salisbury, N.C. 28144.

EARN Money repairing vacuum cleaners. Information, \$1. P.O. Box 322, Poughkeepsie, N.Y. 12602.

MAILORDER—Stop looking! Get your own catalog! No investment in products! 100% mark-up! 72 luxury gifts! Methods, 5800-FD, Lafayette Hill, Pa.

MONEYMAKING OPPORTUNITIES

CO-PUBLISH Mail-order magazine. Earn money, 25¢ brings copy. Link, 1711 Debeneben, Houston, Texas.

PIANO Tuning quickly learned with an approved home study course. Diploma granted. Send for free booklet "Your Future Security". American Piano Tuning School, Gilroy, Calif. 95020.

YOUR Classified Ad in this space will be seen by more than 146,000 active mailorder buyers. For rates and information write: Classified Ad Dept. 96, Science Digest, 575 Lexington Ave., New York, New York 10022.

LETTERS

BUY IT WHOLESALE

MENS Calendar watches \$5.50. Two yr guarantee.
Ace Watch Co., Chenango Forks, N.Y. 13746.

WATCHES, OLD GOLD, JEWELRY

CAMEL Brooch hand wrought in silver, sent to you from Bethlehem, Jordan, \$3.95. Frank Fraizer, 4437 Camero Ave., Los Angeles, Calif. 90027.

PHOTO SUPPLIES

PHOTOGRAPHY For pleasure or profit. Learn at home. Practical basic training. Long established school. Free book. American School of Photography, 835 Diversey Parkway, Dept. J226, Chicago, Ill. 60614.

PHOTO Log pocket size $6\frac{1}{2}$ x $4\frac{3}{8}$. Day, time, subject, lens, speed, light, stop, etc. Space for 540 takes in one pocket-size book. Also Flash Bulb Guide, Conversion Table, Model Releases, for b/w or color. Only 89¢ ppd. 3rd class. House of Napier, P.O. Box 422M, Pasadena, Calif. 91102 Dept. S9D.

MOTION PICTURES AND SOUND EQUIPMENT

WE Pay cash for used 8mm movies. Details free. Hart, Box 452-B, Birmingham, Michigan.

RADIO, TELEVISION AND HAM EQUIPMENT

CHANGE B/W TV to novel color, only \$2.98. State size of screen. Detecto Electronics, 4725 45 N.E., Seattle, Wash. 98105.

MUSIC AND MUSICAL INSTRUMENTS

SONGWRITERS Wanted, send lyrics or songs. Tin Pan Alley Records, 1650-SD Broadway, New York 10019.

GOVERNMENT SURPLUS

GOVERNMENT Surplus how and where to buy in your area, send \$1.00. Surplus Information, SD Headquarters Building, Washington, D.C. 20006.

ADVERTISING AGENCIES, ADV. SERVICE, MAILING LISTS

MAILING Lists on labels. Ladies or men mail. Buyers \$20. M. Roy, Box 1409A, Akron, Ohio 44309.

PRINTING, MULTIGRAPHING, MIMEOGRAPHING, GUMMED LABELS

1000 EMBOSSED Business cards \$3.75. Samples free. K. B. Moyer Co., 3009 Harrison, Kansas City, Mo.

PRINTED #10 Envelopes, 100—\$1.25. Letterheads same, 250 ea. \$5.75 ppd. Premier, Box 2453-D, Sacramento, Calif. 95811.

PRINTING—Send for samples. Gaffney, 110B Ashburton, Yonkers, N.Y. 10701.

1000 NAME Address labels \$1.00. 3 sets same or different name \$2.25. Earn money at home. Details: Ellison Enterprises, 24330 Main, Perris, Calif.

1000 NAME-Address labels—\$1.00, free plastic case—3 lines type—28 letters each line. 3 week delivery. Treasures, Box 50113, New Orleans, La.

100 BUSL. ($5\frac{1}{2}$ x $8\frac{1}{2}$) & Envel. \$2.75 PP 4th zone. Smittys, 170-05A Baileyston Rd., Jamaica, N.Y. 11434.

Air Force computers

In your May '66 issue, you have a column headed "I See Where They . . ." in which the lead item concerns the use of computers in the Air Force personnel system.

What you have said about there being three computers at Offutt Air Force Base may be true. However, we in the personnel business are proud of our computer at Randolph Air Force Base, Texas, which is the

RUBBER STAMPS AND OFFICE SUPPLIES

CORRECT Typing errors without erasing. TCT for 5000 corrections \$1.00. T.C.T.—Box 95, Windermere, Fla.

3-LINES On pocket or office style block or script letters \$1.00 p.p. Bill, Rt. 6, Fayette, Ala.

PERSONAL

TRANSISTORIZED Burglar alarm \$39.95 prepaid. Money back guarantee. Brochure free. Headlite Products Co., Box 569, Glen Cove, N.Y. 11542

CHRISTIAN Tracts mailed anywhere. Christian Tract Center, Rt. 2, Box 142-F, Winter Garden, Fla.

1000 NAME & Address labels in plastic box \$1.00. 3 Line pocket rubber stamp in case \$1.00 ppd. Tole House, Box 2521, Hollywood 28, California.

BILL Problems? Poor credit no trouble. Not a loan company. Send for free application. Automatic Acceptance, 307SD Pocasset Ave., Providence, R. I.

WANTED—MISCELLANEOUS

MERCURY-Gold-silver-platinum for cash. Circular Ore assays. W-Terminal, Norwood, Mass.

BUCK Rogers toys, comics, big little books, casting molds, P. Zarilla, 600 Va Ave., Rochester, Pa.

MISCELLANEOUS

WANTED: Piano rolls ampio & duarot; also a nickelodian with drum. A. Newton, Ingomar, Pa.

COMIC Books 30 different 12¢ type for \$2.00. U.S. Comic, Bx 22A, Cuyahoga Falls, Ohio 44223

NEW Mexico simultaneous lease drawing service. Western Oil Scout, P.O. Box 6822, San Antonio, Texas 78209. Annual Service \$25 monthly report.

THE Wonder Wheel. A copyrighted mathematical tool for Ohm's Law. \$2.00 cash, postpaid. Beck Radio, 3810 Leile Avenue, Tampa, Florida 33616.

ZIP Code directory list every P.O. in the U.S. and possessions over 35,000 listed 1 dollar P. P. Lewis Sales, Box 123, Clarendon Hills, Ill. 60511.

DIRECTORY Of ideas, gadgets, patents, inventions for sale \$2.00. Daoust, 3138 Wilson, Chicago, Ill. 60625

location of Headquarters, USAF Military Personnel Center. It is from this location that the assignments of most of the Air Force personnel around the globe are determined. The USAF Military Personnel Center is an operating staff function of the Deputy Chief of Staff, Personnel, Hq, USAF, Washington, D.C. As such, it provides for the computerized, professional management of the personnel resources of the Air Force as part of its mission.

ROBERT K. PIERCE, JR.
CWO, USAF
Washington, D.C.

Plain science news

I believe that *Science Digest* is the greatest source of simple and condensed science news written in plain language. I always look forward to your new issues and very often refer to previous ones with just as much interest. There is always something new, so it is always a pleasure to read *Science Digest*.

GEORGE A. MANITASAS
San Francisco, Calif.

Asimov and UFO's

I was quite shocked by the article "UFO's—What I Think" by Isaac Asimov (June '66). He seems to group all believers as immature, childish, crackpots, and to think that everyone who sees a UFO is a person with spots in front of his eyes or a wild imagination. How can such a good magazine print something so unscientific?

J. FRANCIS MURPHY
Chicago, Ill.

Several times in past years, *Science Digest* has printed articles about

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UFO's. In reading the articles, I find the authors tend to scoff at UFO's and UFO believers. They also appear to believe that there is a lack of UFO evidence to support the theory that they are intelligently controlled and more than likely from outer space.

As a member of NICAP (National Investigations Committee on Aerial Phenomena), I submit that there are facts available. They are in "UFO Documentary Evidence," published by NICAP in 1964 and presented to members of the U.S. Congress. You may be interested to know the public is writing NICAP 1,000 to 1,500 letters daily, asking for UFO information, joining NICAP, etc.

R. J. MACDONALD
Oakville, Ontario
Canada

I would like to compliment *Science Digest* for publishing Asimov's UFO article, which attacked the saucer craze with a basic characteristic of science: proof. It would be a shame if people spent their time and money searching for celestial invaders when proven evils, such as heart disease, need attention.

BARRY KRAUSE
Joliet, Ill.

Let me clarify the term "unidentified" for Dr. Asimov. The word's meaning depends on who is using it. If the Air Force, the so-called official investigators, is using it, unidentified means not able to be immediately related to some natural phenomenon, which will later be concocted as a solution. For the unbiased scientific observer, unidentified means, simply, unable to be related to any object or phenomenon known to man.

As far as the Michigan sightings were concerned, the theory of marsh gas as an explanation, first presented by Dr. Allen Hynek, the Air Force's consultant, was only in reference to a dozen of many sightings. This theory was challenged by other scientists.

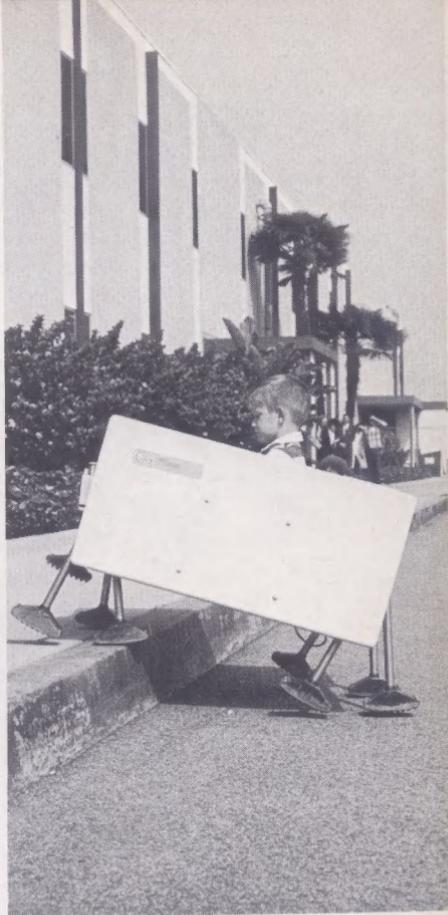
As [for] people's taking rides in space ships, these claims are unsubstantiated and are from generally unreliable sources. They are not considered as valid claims by anyone investigating UFO's. Close-up sightings do exist, however, with multiple witnesses.

Dr. Asimov says he won't accept anybody's word until a UFO obligingly sets down in front of him for his personal examination. Unfortunately, this is highly unlikely, as almost anyone with a kindergarten education may figure out. Any people as apparently far advanced as those who control the spaceships, if that is what they are, should find very little reason for letting human animals crawl all over their vehicles.

To answer his questions as to why these craft are always seen in desolate regions, they aren't, they have been seen everywhere, including major cities. Secondly, most of our land is still relatively desolate and, thirdly, there is undoubtedly a certain disadvantage in going where you would be bothered.

It is not the estimated 50 million people who wonder just what those objects are in the sky that are clinging to a fantasy of security, but those who refuse to believe in the possibility of something new, profound and mysterious, that are clinging desperately to a fantasy of security.

RICHARD T. LEE
Steward AFB,
N.Y.



Down-to-earth moonwalker

A SPACE project that failed may prove a boon to crippled children here on earth.

The "Moonwalker" was originally developed by Space-General Corp. of El Monte, Calif., as a vehicle that could carry equipment over the rough surface of the moon. NASA turned down the idea.

But when one NASA official, Dr.

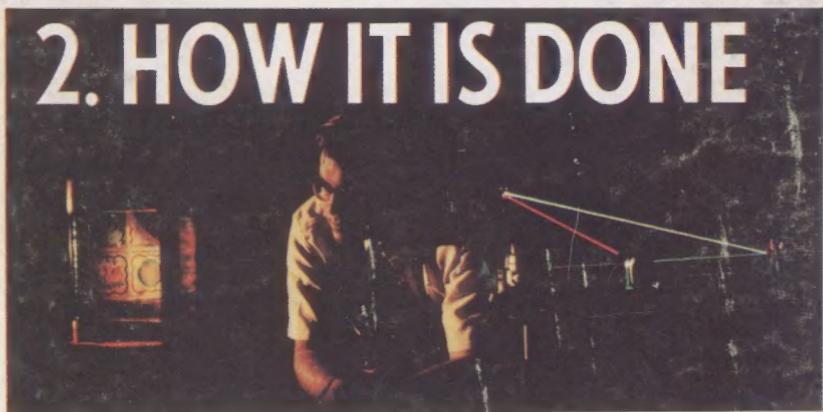
Richard Brenneman, showed a picture of the Moonwalker to his pediatrician wife, Dr. Mary L. Brenneman, she got the idea that the device could be adapted for use by paraplegic and amputee children.

The eight-legged chair is stick-operated and can climb curbs, walk through grass and sand. It is now being studied by doctors at UCLA.

1. THIS OBJECT ISN'T HERE



2. HOW IT IS DONE



PHOTOS BY A. A. FRIESEM

Three people stared at the red and green cookie jar (Picture 1). All could see the jar from any angle and move around it. One looked at an embossed eagle, one at a star pattern. The third put out his hand to lift the pointed top. It wasn't there. In fact, the whole cookie jar wasn't there. Was the jar a dream, a shared illusion? It was three-dimensional and in color. What the people were seeing was a hologram reconstruction — a what? For the complete story, including the set-up in Picture 2, turn to page 30.